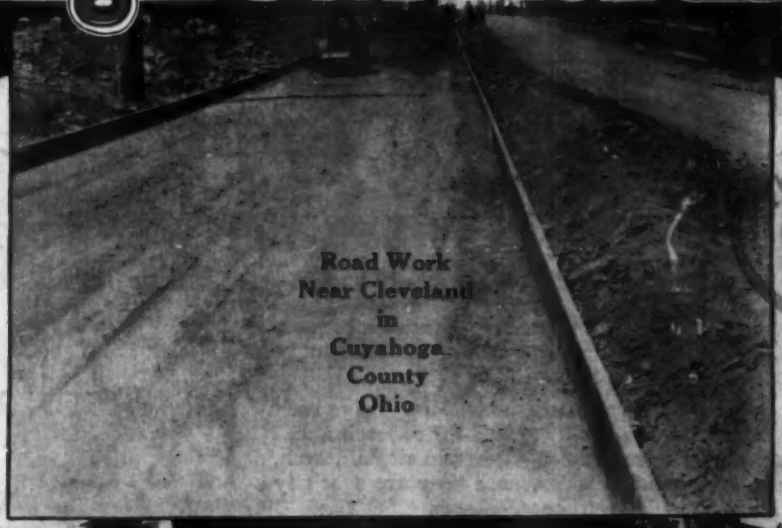
Contractors and Engineers Monthly



Road Work
Near Cleveland
in
Cuyahoga
County
Ohio

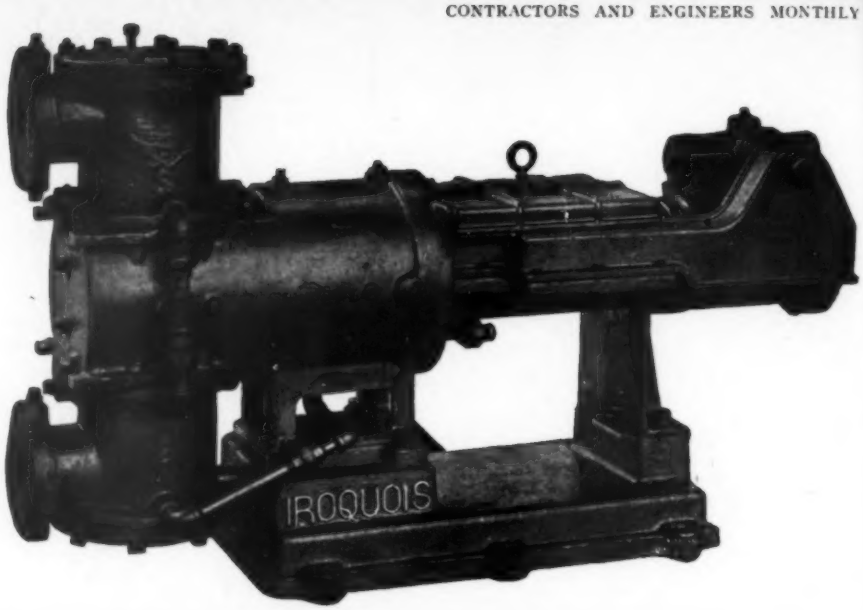
THE JOHN CRERAR
JAN 16 1928
LIBRARY

JANUARY
1928

25 Cents
$1 a Year

JOHN CRERAR LIBRARY

There are certain definite reasons for the popularity of the



IROQUOIS Steam-Jacketed Pipe, Fittings and Pumps

Because it has been found from experience that the Iroquois system is so quick, safe and economical, users unhesitatingly say it is the most efficient ever devised.

Iroquois Steam-Jacketed Pipe, Fittings and Pumps give such complete satisfaction in asphalt, oil and coal-tar refineries, and plants manufacturing prepared roofing, gas, chemicals, starch, glucose, molasses, fatty acids, etc., because they are specially designed for those particular purposes.

Some of the distinctive features which distinguish the Iroquois Steam-Jacketed Pump are:

Minimum number of working parts in contact with material being pumped.

Large wearing surfaces to reduce wear.

Large, straight passages for liquid being pumped.

Simplicity of construction insures low maintenance cost.

Ease of operation with no skilled attention.

Steam jackets cover all moving parts—pump can be started and stopped at will without cleaning out.

Perfect accessibility of all wearing parts.

No springs or small, easily broken parts in valve chambers.

Handles successfully viscous material containing large quantities of foreign matter without undue wear or operating troubles.

for pumping asphalt and other viscous materials that will not flow at atmospheric temperatures

Write us today for full data and specifications. We will also send you information regarding the complete Iroquois Line of road-building machinery.

Iroquois Sales Department

THE BARBER ASPHALT COMPANY
PHILADELPHIA

New York Chicago Pittsburgh St. Louis Kansas City San Francisco

Vol. XVI No. 1 CONTRACTORS AND ENGINEERS MONTHLY, JANUARY, 1928 Price, 25 Cents; $1 a Year
Entered as second-class matter, April 16, 1913, at the Post Office at New York, N. Y., under Act of March 3, 1879. Issued Monthly by The Buttenheim-Dix Publishing Corp., 449 Fourth Ave., New York. Printed in U. S. A.

EDGAR J. BUTTENHEIM, President | THEODORE R. KENDALL, Editor | L. WEYAND, Associate Editor | HERBERT K. SAXE, Treasurer | MYRON MACLEOD, Advertising Manager

Vol. XVI
No. 1

Contractors and Engineers Monthly

January,
1928

Published Monthly at 443 Fourth Ave., New York, by Buttenheim-Dix Publishing Corporation. *Branch Office:* Tribune Tower, Chicago, Ill. Tom Dix, Vice-president; Prentice Ford, Western Advertising Manager; George Conover, Assistant Advertising Manager.

TABLE OF CONTENTS

BRIDGE CONSTRUCTION
A Spiral Bridge Approach with 32 Years' Service..... 18

CARTOON
Pathos in Construction..... 72

COSTS
Cost Data on Staten Island Boulevard Excavation..... 50

DAM CONSTRUCTION
Problems in Concrete Dam Construction..... 25

DISTRIBUTORS OF CONSTRUCTION EQUIPMENT
Portrait Photographs of Prominent Distributors..... 30

EQUIPMENT AND MATERIALS

AIR COMPRESSORS
Well-balanced Portable Air Compressors..... 56

CONCRETE
Kerosene-burning Concrete Heaters..... 52
A One-bag Concrete Mixer..... 54
Paper Bags for Portland Cement..... 66

ENGINES, OIL, GAS AND DIESEL
An Air-cooled Engine for Construction Use..... 60

EXCAVATION
A New Light-weight Ditcher..... 48
For Snow Removal and Excavating..... 52
Motor-driven Shovels..... 60
Skimmer Scoop Has Three Special Features..... 62
Fewer Parts in New Shovel-Crane..... 64

HAULING AND DIRT MOVING
A Bottom-dump Trailer for Heavy-duty Tractors..... 54
Hydraulic Dirt Mover Breaks Records..... 62

LOCOMOTIVES
A Diesel-powered Gear-driven Locomotive..... 64

MISCELLANEOUS EQUIPMENT
Economy in Sprocket Wheels..... 58

PUMPING
Sand Pumping for Producers..... 48
A 95-pound Pumping Unit..... 54

ROAD
A Sub-grade Scarifier..... 52
A Motor Roller with Duplex Worm Drive..... 56
A Specially-designed Grading Roller..... 58
Scarify, Grade and Roll in One Operation..... 62
A Motor Grader with 2-ton Tractor..... 64
A General Utility Motor Grader..... 68

WELDING
A Motor-driven Arc Welder..... 66

ITEMS OF INTEREST
Road Courtesy—Not Dead but Dormant..... 27
Better Plans and Specifications..... 46
Construction Industry News..... 70
Standardization of Replaceable Cutting Edges..... 13
Advantageous Reading for Contractors..... 74

LAW AND LITIGATION
Legal Notes for Contractors..... 28
When Unexpected Obstacles in Soil Are Met..... 28

LUMBER AND TIMBER
Lumber Industry Prepares for Greater Year..... 27

MANUFACTURERS OF CONSTRUCTION EQUIPMENT AND SUPPLIES
Portrait Photographs of Sales Officials..... 36

PHOTOGRAPHS
Of Prominent Equipment Distributors..... 30
Of Sales Officials of Manufacturers..... 36
Index to Photographs..... 42

ROAD CONSTRUCTION
Notable Texas Road Project..... 1
Road Work in a Swamp..... 5
The Cleveland-Mayfield Road..... 10
5.4 Miles of 3-strip Highway..... 15
See also "Equipment and Materials"

ROAD SHOW—JANUARY 9-13
Notes of Exhibits..... 68

SAFETY IN CONSTRUCTION
Safety in Ditching..... 14
Accidents on Public Utility Properties..... 18

TUNNEL WORK
Material Handling Methods on the Great Northern Cascade Tunnel..... 19

WATER WORKS CONSTRUCTION
Concrete Stops Reservoir Leaks..... 8
Problems in Concrete Dam Construction..... 25

WELDING
Welded Roof Truss Is Lighter than Riveted Truss..... 60
See also "Equipment and Materials"

WHO'S WHO IN CONSTRUCTION
Data from Active Contractors..... 47

WIRE CABLES
How to Splice Wire Cables..... 43
Lubrication of Wire Rope..... 58

L620.51
C763

541553
271749

Only THEW has the Center Drive

Gasoline or Electric Powered

LORAIN 60 AND 75

THE THEW SHOVEL COMPANY

Lorain, Ohio

Shovels Cranes Draglines Backdiggers

Please mention the CONTRACTORS AND ENGINEERS MONTHLY—it helps.

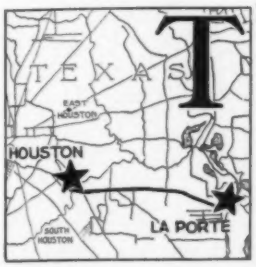
Volume XVI
Number 1

Contractors and Engineers Monthly

January,
1928

Notable Texas Road Project

By A. J. Wise
County Engineer, Harris County, Texas



THE La Porte Road, lying between Houston, Texas, and the bayshore town of La Porte, a distance of 17.4 miles, was decided upon by the Commissioners' Court and the Citizens' Advisory Committee as one of the first highways to be constructed under the $7,000,000 bond program. The road is used by most of the people of the City and County, at one time or another, for the reason that it serves as a means of going to and from the bayshore region.

For convenience of construction and in order to avoid, as far as possible, inconvenience to motorists, the highway was divided into four sections. Three of the sections lie between Harrisburg, a suburb of Houston, and a railway crossing of the Southern Pacific 13.5 miles distant or 4.2 miles from the town of La Porte. The fourth section was laid out over an entirely new route parallel to the railroad to an underpass which eliminated the only two dangerous grade crossings. The road section was built to a 36-foot width, including a 20-foot solid concrete slab and 8-foot dirt shoulders. The contract for 4-foot shell shoulders was let separately.

A contract was made with the Tibbetts Construction Co., of Fort Worth, on a low bid of $506,865, plus a $1,500 bonus for completion of each of the first three sections by fixed dates. The first section of the road, 3.8 miles in length, was to have been completed under the contract by June 1, but was finished April 30, a month ahead of schedule. The second section was finished the last of May and the third section the end of June. This record was by far the best ever made in Southeast Texas. The last section, purposely delayed for several weeks to give the new grade time to settle sufficiently, was finished the last of October, 1927. The added width above 20 feet through the town of La Porte was handled by the Tibbetts Construction Co., through contracts with property owners. The financing of the special job was handled by the company through a local bank. In this way the company was relieved of the necessity of carrying long-time paper.

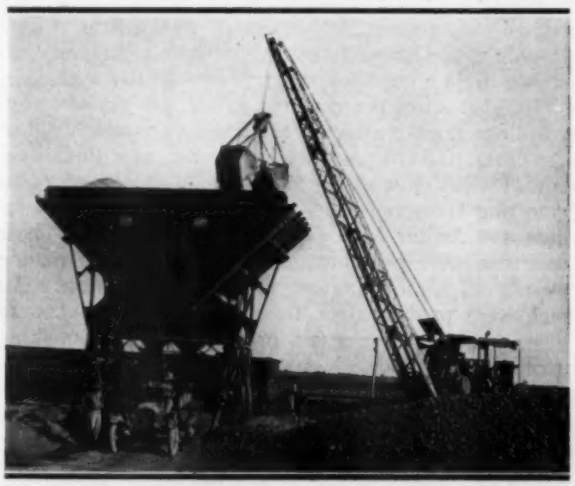
Be it said to the credit of the Tibbetts Construction Co., the business men of La Porte showed a preference for having the extra paving handled by the Tibbetts Construction Co. The job offset in a measure the loss from their original contract of 2287 feet of paving in the town of Harrisburg at the opposite end of the road.

In view of the decision of the Commissioners' Court to pave the Harrisburg section as a city street with curb and gutter, the demand of the Harris County Auditor for a separate bid for the 45-foot section was acceded to. A. M. Arnold & Co. were successful bidders on concrete base with Uvalde rock asphalt surface.

Type of Construction

The highway is of the modified Bates type of construction, 9-6-9 inches with 38 pounds of wire mesh per 100 square feet. No expansion joints were used except where the work was interrupted for more than 30 minutes or at the end of a day's run. In sections one and four, the last two completed, the usual expansion filler was omitted. A dowel joint was used.

Where expansion joint felt had been used it was observed that some spalling occurred. Because of compression near the surface of the pavement, caused by



Gravel is Unloaded from Railway Cars by an Orton Crane to a Johnson Loading Bin

R. B. (Pete) Butler, Superintendent on the La Porte Road Job

tamping, it was found that the concrete within an inch or two of the surface was closer together than at the bottom. This caused an uneven joining of the slabs with some consequent spalling when expansion occurred. By omission of the bituminous filler, unevenness of compression was eliminated.

Thus far there has been no "blow-up" or the slightest indication of a possible rupture. Cracks have occurred in the first pavement laid about 100 feet apart on the average. These have been filled with asphalt preparation promptly.

The 28-day tests on cylinders which were made daily show an average crushing strength about 50 per cent above the contract requirement, which was 3,000 pounds per square inch. Core tests have been made, but the results are not yet available.

Construction has been in compliance with government standards. At the outset of the present $7,000,000 highway program, observation trips were made to the Arlington Experimental Farm and the Bates test road in Illinois. The latest methods were studied also in most of the States north of the Ohio River. The knowledge gained in this manner was, of course, coupled with knowledge from past experiences in highway construction in the low lying coast country of Southwest Texas, 30 to 40 feet above sea level.

Fortunately, for the first major project under the bond issue, the contract was made with a firm of high standing, who showed themselves anxious in every instance to do a good job.

To start with, the concrete mixer was timed to revolve one minute after all materials were assembled in the drum, and the governor key turned over to C. Leeland Tindall, Engineer on the job for the County Engineering Department. P. H. Tidwell was mixer foreman and Arthur M. Lovelace, paver operator. These two men were paid bonuses for every foot of paving over a stipulated amount for any day's work. All men were paid straight time for overtime, but were given bonuses of one, two or three hours for making exceptional records.

Several unusual records were established by Tibbetts. With one 27-E Multi-Foote paver, working a single crew of men on a single shift of a varying number of hours, the contractor consistently exceeded the daily progress estimate of 600 lineal feet of 20-foot, 9-6-9-inch pavement.

MODERN MACHINERY MAKES GOOD RECORD

The pouring of concrete started on April 4, and the largest records were made during that month and in May. A total of 944 lineal feet was laid on April 7; 1,144 lineal feet on April 10; 1,522 lineal feet on April 14th (in 14 hours and 15 minutes straight working time); 1,322 lineal feet on April 30; 1,392 lineal feet on May 9, and 1,613 lineal feet, or 3,584.4 square yards, in 14 hours and 44 minutes, on May 26.

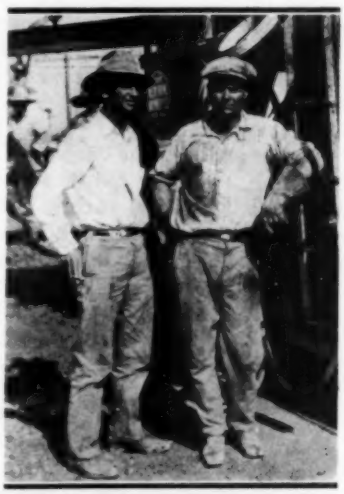
The Tibbetts Co. was equipped with the most modern machinery, which was kept in excellent condition. In the main, the equipment consisted of Johnson loading bins, an Orton ¾-yard clamshell bucket-crane; Lakewood subgraders; a 27-E Multi-Foote mixer; a Lakewood concrete spreader; and Heltzel 9-inch steel road forms.

The records established were made possible partly on account of ideal weather conditions, a level country and splendid facilities for the handling of materials and equipment. At the same time there was excellent team work and cooperation between the contractor, crew personnel and engineers. The Tibbetts Co. had a force of men unusually well organized under R. B. (Pete) Butler, son of W. W. Butler, General Manager, who was Superintendent on the job.

The La Porte Road is parallel to the Southern Pacific Railway for its entire distance, practically. Switches are located at six convenient intervals. This made possible short hauls on all material. The crews were able to tear down, move and set up loading bins and loading equipment, in 36 hours, over distances of two and three miles.

CONSTRUCTION OPERATIONS

The old section of the road had a shell base, two to eight inches thick, and a thin asphalt covering about 18 feet wide. The road was thoroughly scarified to a width of 20 feet with a 10-ton Caterpillar tractor and a Russell 12-foot road machine with scarifying attachment. The scarified subgrade material was reshaped to as uniform a grade line as possible, and an excellent



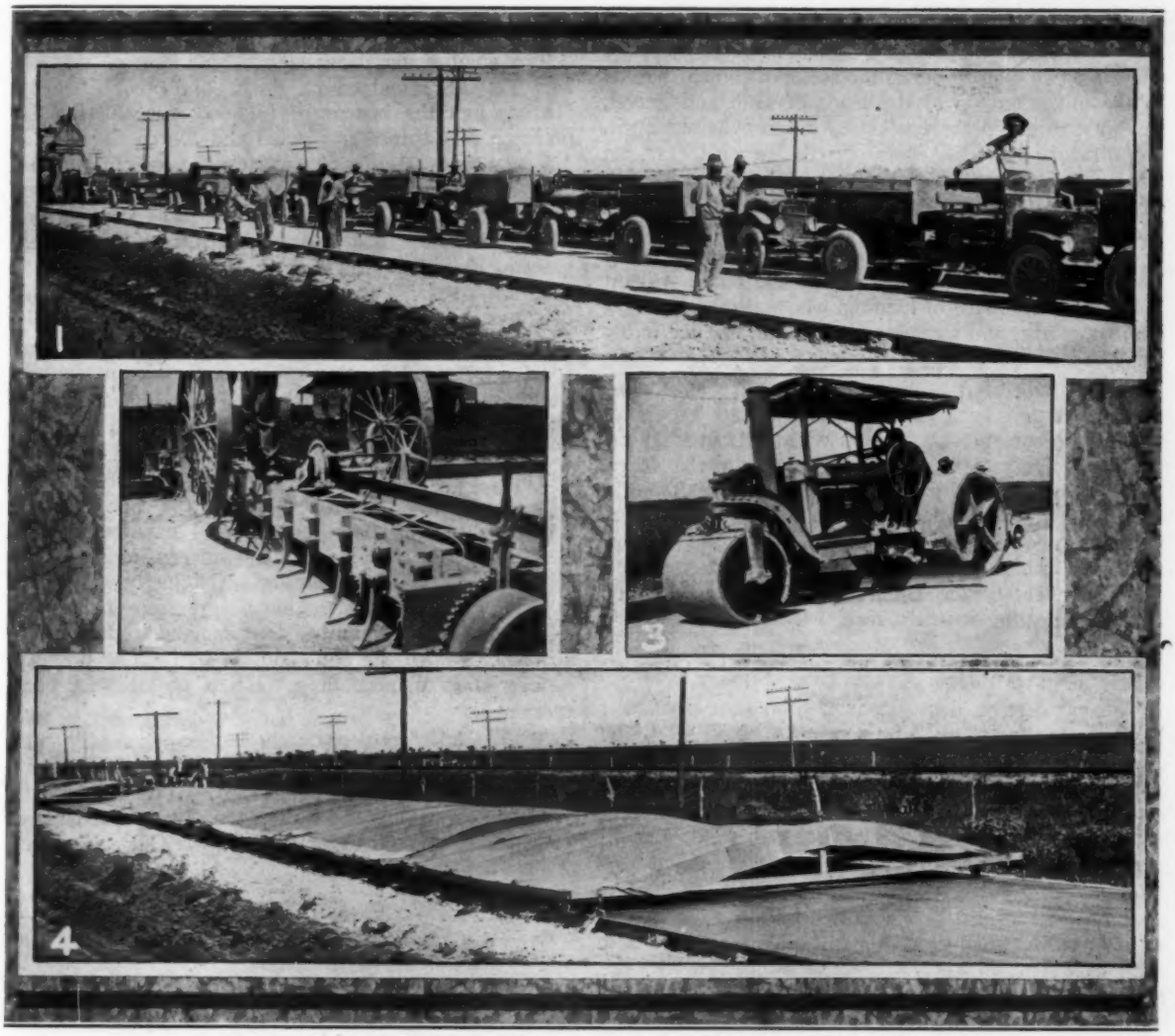
P. H. Tidwell, Right, Mixer Foreman, and Arthur M. Lovelace, Power Operator, Who Won Several Bonuses for Good Yardage on the La Porte Road Job

grade line established with a minimum movement of material. The road metal was thin in only a few places and the amount of new material that had to be added was negligible.

After scarifying and reshaping, a careful profile was run and a grade line established to fit the section as nearly as possible. Then the forms were set. The Lakewood subgrader was pulled over the forms, cutting the subgrade to the exact section, line and grade. This was done during the noon hour and late afternoon. The machine with a 10-foot longitudinal float.

A rubber hose was rolled over the surface to remove surface water. The surface was hand-belted and the sides edged.

Due to difficulty in keeping the dirt levees water tight the ponding method of curing was abandoned. Instead, two inches of earth covering were put on the new concrete and kept moist for 14 days. Water was supplied for both mixing and curing through a 3-inch water line running to a convenient pumping station.



CONSTRUCTION OPERATIONS ON THE HOUSTON-LA PORTE ROAD

1. *Line of Ford trucks operating between the central proportioning plant and the mixer. Note the excellent condition of the subgrade.* 2. *The Lakewood subgrader.* 3. *A Galion motor roller used on the subgrades.* 4. *Covers to protect the green concrete from the sun until setting was completed, when the earth cover was placed*

use of the grader eliminated a large amount of hand labor.

The subgrade was thoroughly rolled and the forms carefully relined and regraded. At the mixer, the raw concrete was first struck off by hand to a 3-inch thickness. The wire mesh reinforcing was put into place and the top layer of concrete immediately dumped. This also was struck off, tamped and belted by a Lakewood finisher. Two hand-finishers followed the finishing A 2-inch line first was tried, but found to be inadequate.

LABOR EMPLOYED

On scarifying and reshaping, the contractor used a Caterpillar tractor operator, a road machine man and one helper. For the setting of the forms, two skilled men and six unskilled workers were used. Ten men were employed to shovel material in and out of the roadway between forms.

Ford Tractor With String of Atlas Trailers Used to Haul Concrete from the Railway Cars to the Loading Bins

At the mixer, there was a foreman, checker, mixer operator, two men to dump the sacks of cement hauled to the mixer on top of the loads of sand and gravel, two men to dump the trucks, 10 men in the slush pit, one finishing machine operator with two helpers, and two hand-finishers. Ten men were used on the job covering and curing and four men for wetting the dirt. For regrading and lining the forms, two skilled and six unskilled workmen were used. There was one subgrade foreman, one stationary engineer for the pump, a plant foreman at the place of loading, who was assisted by a crane operator, and an operator who handled the measuring boxes.

The hauling of dry batches to the paver was done advantageously by contract. Due to an excess of trucks, the contractor was enabled at all times to get prompt delivery from the batching plant to the mixer.

Plenty of Mexican and negro labor was available in the vicinity of the job. Most of the skilled workers were veterans with the Tibbetts Co. and showed a commendable pride in records made by their employer. Superintendent Butler seldom, if ever, used hard-boiled tactics in dealing with his men.

JETTING TO SETTLE DEEP FILLS

The engineering department desired that Section 4 have ample time to settle on account of some deep fills. As it happened, Tibbetts was the successful bidder on the paving of the so-called Clinton road or the main route to the industrial area north of the Houston ship channel. This enabled the company to hold up conveniently the paving of the new grade for about two months.

Some good results were obtained in dump settling by the water process in deep fills on both the old and new sections of the highway. Two years previous to the paving of the older section, all large bridges were built and deep fills constructed. It was thought that the two years' settlement would be sufficient, but the fills were not compact enough.

In order to make certain of no further settlement after the new slab was laid, it was decided to jet water into the dumps at intervals of 5 feet, under pressure of 60 pounds per square inch. The result was that one dump built 2½ years previously, ranging in depth from 8 to 12 feet, settled 5 to 6 inches. Another dump, built two years previously, and 6 to 14 feet in height, settled from 9 to 14 inches.

The latter dump originally was built by the use of wagons, loaded by steam shovels. The material consisted of alternate layers of clay and sand, but mostly clay. When completed a temporary gravel surface was laid. There had been heavy traffic over the road continuously.

The new dump on Section 4, averaging two feet in height, was water-tamped before the laying of the slab because of extremely dry weather. No rains of any consequence had fallen on the dump since its construction five months previously. Settlement of about two inches on the average was obtained by flooding the dump and thoroughly saturating it for a considerable period.

SUPERINTENDENCE AND TESTING

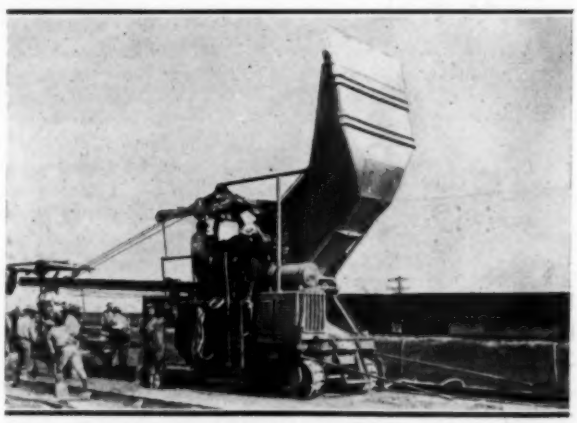
The engineering department's engineer on the job, Mr. Tindall, remained on duty almost continuously. He has had the benefit of highway construction experience in California, Mexico and North Carolina.

Every car load of sand and gravel was screened and analyzed at the point of shipment and closely inspected at arrival at the unloading point. The cement and steel was tested by the reputable firm of testing engineers, Robert W. Hunt & Co. The 1:5:½ concrete mix was used. The consistency of the concrete was held to a 1-inch slump.

During the progress of construction, the road was inspected by engineers and others interested in highway building from all parts of South Texas and from other states. Apparently all were of the opinion that the job did not suffer on account of speed.

The La Porte Road now sets the pace for all other highway construction in this part of the country. The results obtained have been beyond expectation and helpful in the carrying out of the remainder of the County's $7,000,000 program. Originally, the plan was to make the construction program cover a 4-year period, but owing to an insistent demand from the public, the time will be cut about in half. The program now is slightly more than one-half way toward completion.

The engineering department has an unusually competent set of engineers and a staff of workers supervised by the County Engineer, A. J. Wise, his First Assistant, Charles R. Haile, the Superintendent of Construction, E. O. Francisco, and the Office Engineer, A. T. Dickey.

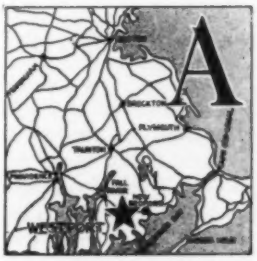


The 27-E Foote Paver, Which Established a Record on the La Porte Road, Operated by P. H. Tidwell, Mixer Foreman

Road Work in a Swamp

By G. E. Foster

Resident Engineer, Massachusetts State Highway Department



A MOST interesting state highway project has been under construction in Massachusetts during 1927 in the town of Westport, between the cities of Fall River and New Bedford. This Federal Aid project is 5 miles long and when completed will be used by eastbound traffic, while the existing highway will serve the westbound traffic. The two roads have been separated by a street railway reservation. The work is being done by the Callan Construction Co., of Bristol, R. I., under the direction of Joseph F. Foley, General Superintendent.

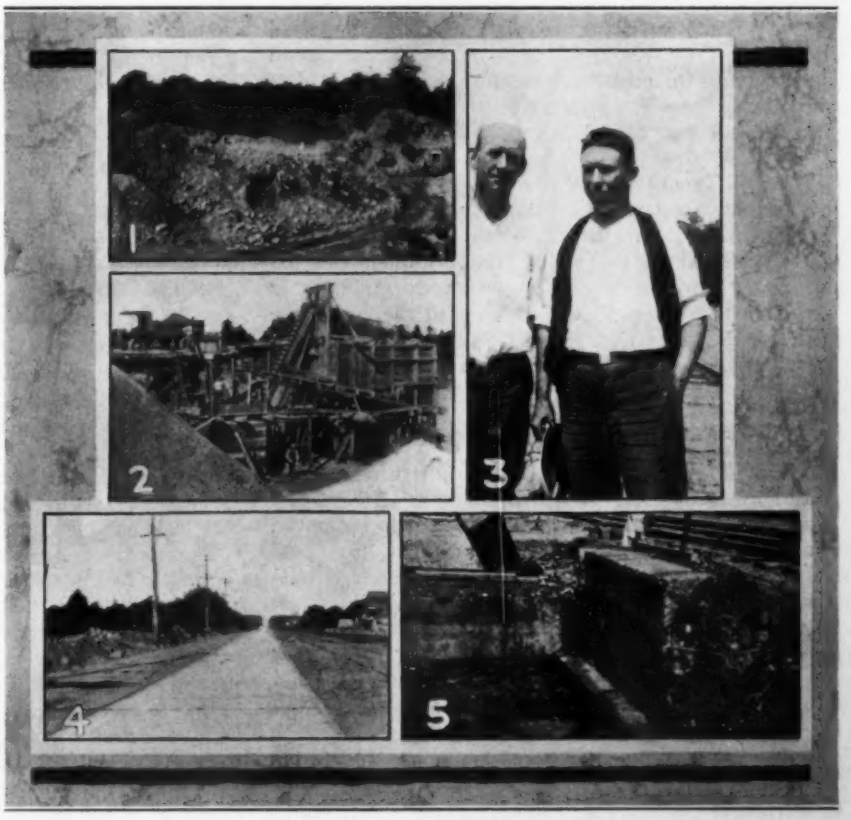
Although this has been an unusually rainy season, water was bound to cause considerable trouble since a large amount of the work was over wet and swampy ground. Work was commenced on June 13, 1927, and is expected to be completed August 1, 1928.

Earth Excavation

The earth excavation, about 50,000 cubic yards, was sublet to B. F. Watkins, of New Bedford, who employed three Thew gasoline shovels and one Marion steam shovel to carry out his work. Where the various swampy sections were encountered, the loam and undesirable material was excavated and gravel borrow used to make the fill. Since there was so much water it was deemed inadvisable to backfill with ordinary borrow or excavated material from the cut sections, as this material seemed to absorb the water and make rolling or trucking on it an impossibility after it had been filled about 24 hours.

Peat Excavation

The peat excavation, about 25,000 cubic yards, was sublet to F. W. Carlson, of Bridgewater, who used a very unique method in handling his work. He cleared the brush and trees the full width of the excavation and the full width of the spoil bank, leaving a row about 5 feet wide between these two clearings untouched to help hold the spoil bank from slipping into the "canal." A Byers Bear-Cat, with crawler tread and a ½-cubic-yard clamshell bucket, was used to excavate the peat and cast it to the spoil bank. In the path of the excavator, brush and trash from the clearing were piled to support old railroad ties used in place of mats. The peat was cast to a spoil bank parallel to the cut and leveled off. The water level in this swamp was generally a few inches higher than the ground and on one occasion, the Byers Bear-Cat was mired so badly that the forward end of the frame rested on the peat. Several methods were used in an endeavor to pull out the machine, such as straight pulling with an electric work car, straight pulling with three loaded trucks and also a snatch block with two loaded trucks. Finally two track jacks were used to raise and crib the front end of the frame until the machine leveled once more. It was difficult to get good bearing for the jacks as well as the cribbing which, along with the suction of the peat took the best part of four days to get it out.



SCENES ON THE WESTPORT JOB

1. *Steam shovels at work in gravel bank where concrete aggregates were obtained.* 2. *Main crusher and screening plant, showing belt conveyor from tailing chute to crusher.* 3. *At left, G. E. Foster, Resident Engineer, Massachusetts State Highway Department. At right, J. F. Foley, Superintendent for the contractor.* 4. *Part of the 2½ miles of concrete surface already laid over what was swamp three months previous.* 5. *The 8-inch concrete wall built at the end of an old culvert where a blow-out occurred alongside the new concrete culvert*

TRUCKS MIRE CONTINUALLY

This section of the work was perhaps the most interesting on the project, as well as the most exciting. From the contractor's point of view, it was the most costly. It was a common occurrence to see from one to five trucks on the fill at any time at any part of the day. The only sure way was to keep at least one loaded truck on hard ground to act as a rescue truck and pull out those that were stuck. On several occasions trucks lost their footing and were standing on end in the peat. One was in so badly that it was necessary to run a steam shovel down and lift it out. Another was in the same predicament when there was no steam shovel handy and it was raised with two sets of chain falls and then cribbed and towed out.

The peat swamp is 6,000 feet in length and was excavated to blue clay at an average depth of 6 feet and a width of 37 feet, to take care of a 1:1½ slope from the edge of the proposed surfacing. Due to the vast amount of water the section excavated took on the appearance of a canal and was commonly referred to as such. The back fill of ordinary borrow followed closely to the excavation and was made from the far edge of the canal toward the spoil bank, uniformly, in order to force to the spoil bank any clumps of peat which the clamshell missed. The peat that was in suspension was also forced over, thereby insuring a solid fill of suitable material. In many instances, however, this surplus peat could not be controlled and sometimes it forced its way up the canal at which time the fill was put in square across to pocket the surplus peat and hold it until it was later removed by the Byers Bear-Cat and then the fill was completed the full width.

TROLLEY COMPANY COOPERATED

Since the street railway company had double tracks through this section with a cross over on each end, the officials offered to use single track through the job during the excavation of the peat and consequently moved their pole lines from the edge of the cut to the center of the unused tracks. This made it possible for the contractor to work to better advantage.

PAVING

The entire stretch is subgraded with 12 inches of gravel and surfaced with 8 inches of reinforced concrete 20 feet wide for most of its length. At the Fall River end the street railway reservation is to be moved to one side and 43 feet of concrete surface made to take traffic in both directions. At a point a half a mile away, the traffic will then be separated by the street railway reservation and the previously described 20 feet of paving will take care of the eastbound traffic. Where the shallow cuts and fills were made, the surfacing has been laid (a distance of 2½ miles) the remainder of the peat swamp and the heavy fills being allowed to settle over the winter before laying the pavement.

The cement concrete surfacing was laid by the Callan Construction Co., one-half width at a time. Mr. Foley, the superintendent, had a well-organized crew and a well-equipped outfit for doing his concrete work, making good speed and showing efficiency by averaging 1,000 linear feet per day. Fortunately, no time was lost for rainy weather, 13,000 lineal feet of concrete being laid in 26 working days. Most of the rain came at night and on Sundays which was appreciated by the contractor. The mix was 1:2:3½ with 0.08 parts hydrated lime. Obourg Belgian cement was used. The concrete was cured with flake calcium chloride using 2¼ pounds per square yard in place of earth covering and sprinkling. The contractor crushed and screened local gravel for his aggregates.

PROPORTIONING PLANT

The method applied at the aggregate plant was to load bank gravel on trucks with a Mead-Morrison ½-yard gasoline shovel. Two trucks fed the crusher which was equipped with a grizzly. Johnson batch boxes of the six-bag, single-batch type were attached to the wooden bins. Each truck carried four batches. The plant was equipped with a belt conveyor to handle the tailings to the crusher. A small crusher and bin used two years ago by the same contractor and which had not been dismantled was kept full at all times to act as a storage plant and was used when the large crusher was low on aggregates or had minor breakdowns. This system made it possible to keep the paver going on many occasions whereas without such storage, it might have been necessary to shut down for short periods.

The cement was loaded at the cement storage shed which was located near the beginning of the project. On the concrete work the Callan Construction Co. used Metaforms, a 27-E Multifoote paver and an Ord mechanical finishing machine.

A part of the work included the moving of several houses to make room for the new road.

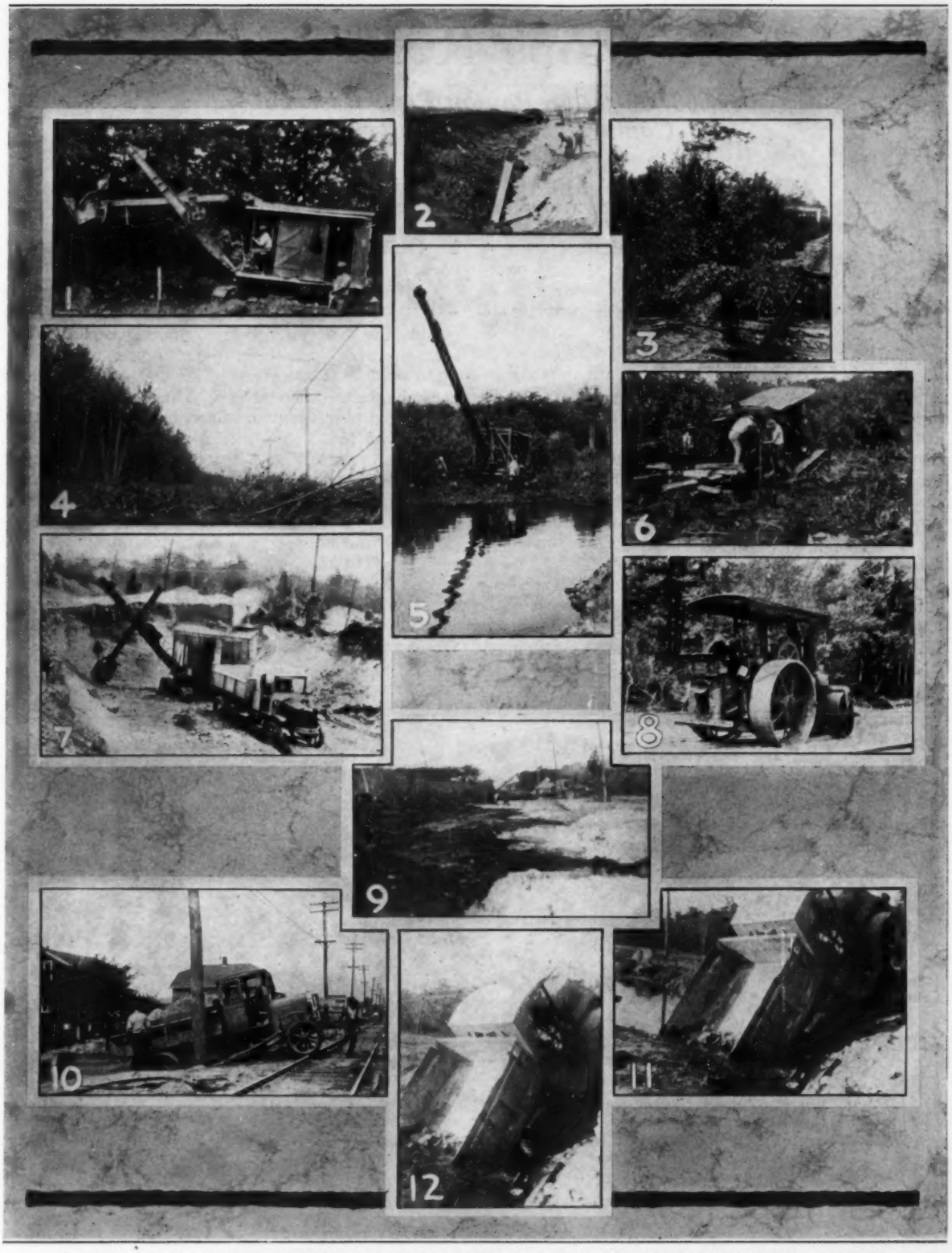
DRAINAGE STRUCTURES

One of the difficulties encountered on this job was the installation of proper drainage structures for surface and underground waters. After extending one of the existing dry rubble stone culverts with a section of reinforced concrete construction, a blow-out occurred near the point where the two joined. My first impression was that a poor connection had been made and if it were left that way, it would ultimately cause a washout under the pavement along the back of the culvert wall. It proved to be under the existing headwall.

The culvert was a 4½ x 3½-foot concrete box culvert and would run full after a rainstorm. Being of open joint construction, the water was evidently forced through the walls and under the headwall. To stop this leak an 8-inch concrete wall was constructed the full length of the old headwall and two feet below the footing. This seemed to have answered the purpose, for since the first washout occurred in July there has been no sign of water at this point.

In several places through the swampy section, springs were discovered and at these points holes were dug, usually 4 feet deep, and filled with stone. From these wells 6-inch pipe was laid to points outside of the slope and surrounded with stones somewhat similar to a pipe side drain to act as an outlet. Through practically all of the cuts it was necessary to lay side drains to take care of the water running from the side hill.

During the 1928 construction season this work will be completed and close the gap of an 11-mile dual road between the cities of Fall River and New Bedford, which are on the Providence, R. I.-Cape Cod through highway.

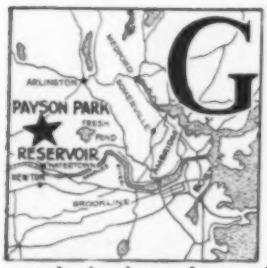


SCENES ALONG THE WESTPORT ROAD JOB BETWEEN FALL RIVER AND NEW BEDFORD, MASS.

1. *Thew shovel handling grading in a stable section.* 2. *Spreading the gravel subbase on one of the sections of cut.* 3 *Site of roadway before clearing.* 4. *Site of roadway after clearing.* 5. *A Byers Bear-Cat with Owen Bucket, which was used for removing peat from the swamp.* 6. *The day the Byers Bear-Cat took its mud bath.* 7. *Erie shovel loading truck at borrow pit.* 8. *Buffalo-Springfield road roller compacting fill.* 9. *Peat in suspension and in clumps which the excavator missed, being pocketed by the back-fill.* 10, 11 *and* 12. *Daily and, in fact, hourly occurrences on the fill.*

Concrete Stops Reservoir Leaks

43,000,000-gallon Payson Park Reservoir of Cambridge, Mass. Water-works Completely Relined



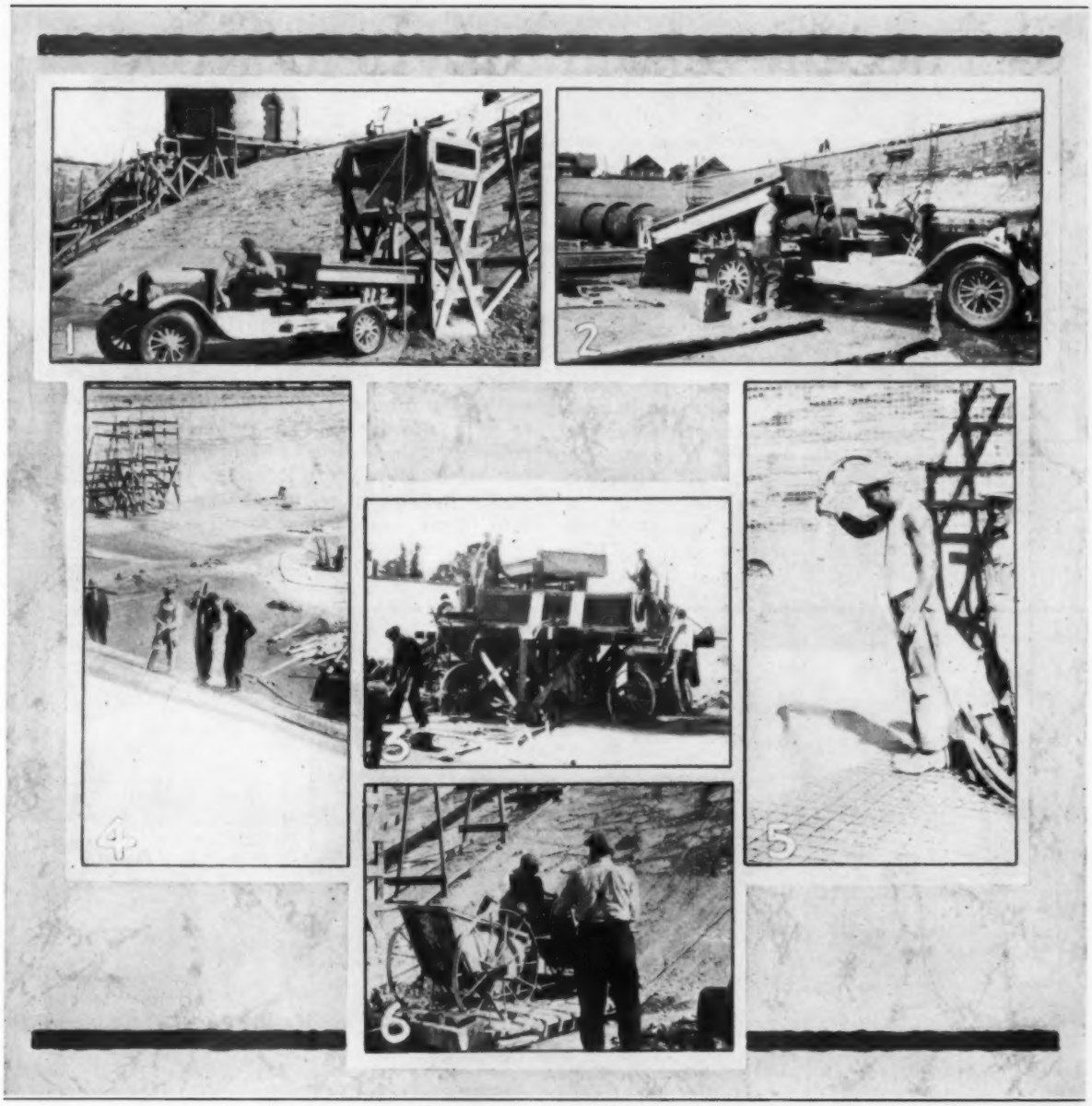
GUNITING has become one of the standard methods of repairing damaged concrete work and for relining reservoirs that have shown signs of leakage. The appearance of numerous springs on the lower slopes of the drill on which the Payson Park reservoir of the Cambridge, Mass., water supply is situated served notice that there were leaks in the walls or bottoms of the two sections. A careful check was made of the flow and it was found that at least one-half million gallons of water per day were being lost. A method of attack was determined and a contract let to the Rust Engineering Co. of Pittsburgh, Pa., for relining the reservoir with gunite, one section at a time.

The first operation after the west section of the reservoir was unwatered was to construct a low concrete wall along the base of the masonry dividing wall to check leakage from the full section. It successfully stopped all leakage and is expected to prevent leakage in the opposite direction when the other section is unwatered for guniting and the west section of the reservoir filled.

Aggregates for the concrete floor and for the gunite were delivered at the site by truck and stock-piled outside the reservoir. Before guniting began on the first unwatered section of the reservoir 6 inches of 1:2½:4 concrete were placed on top of the existing natural cement concrete base. The 2-inch gunite coat was placed over the entire floor of the reservoir, reinforced with No. 5 steel wire, 4-inch mesh steel fabric, weighing 71 pounds per 100 square feet. This concrete was mixed in a Ransome mixer outside the reservoir and raised to the top of the embankment in a skip operated by a Mead-Morrison hoist. It was dumped on the inside slope into a hopper, which was controlled by a lever convenient to the operator of the Ford dump truck which hauled it to the section being concreted. Three-eighth-inch rods, bent at a right angle at the end, were set on 3-foot centers in the concrete, to which the steel fabric was subsequently attached.

EQUIPMENT OUTSIDE THE PAYSON PARK RESERVOIR

1. Delivery of aggregate at foot of reservoir bank. 2. Ransome mixer, showing hand loading from wheelbarrow and skip for hauling mixed batch to top of reservoir embankment. 3. Cement storage shed, Ransome mixer and belt conveyor in front of gate house for gunite mix. In foreground, the Mead-Morrison hoist used on the concrete skip. 4. The concrete skip on rails laid on the embankment carrying mix for the 6-inch floor. 5. The Kent proportional mixer for 2½:1 sand and cement mix for gunite. The conveyor which carries the mix over the embankment is seen running across the foreground



WORK INSIDE THE PAYSON PARK RESERVOIR

1. Dump truck receiving concrete for floor from hopper at basin end of the skip chute. 2. Dumping concrete for the 6-inch floor. 3. Platform where dry gunite mix is dumped for loading pneumatic gunite hoppers. 4. Guniting the sloping wall of reservoir with 2½:1 mix. No. 5 electric-welded steel wire, spaced 4 inches in both directions, was used for reinforcing. 5. Guniting the floor of the reservoir on top of the 6-inch slab, reinforcing same as on slope. 6. Concrete buggy on skid used to remove refuse from reservoir before concreting

The dry gunite of 2½ parts sand and 1 part cement was mixed outside the reservoir in a Kent mixer of the paddle type and discharged onto a belt conveyor running up over the reservoir embankment. The conveyor emptied into a bin from which the dry mix was hauled to a central platform for storage and from which the pneumatic hoppers of the guniting equipment were filled. From the hoppers, the material is forced through a hose by compressed air, dry, and water is added as the gunite leaves the hose at the nozzle.

A Sullivan 300-cubic-foot gasoline-driven compressor inside the reservoir and three Chicago Pneumatic portable compressor units located outside the reservoir supplied compressed air for the operation of the cement guns. The illustrations show the gunite being applied to the walls and to the bottom of the reservoir.

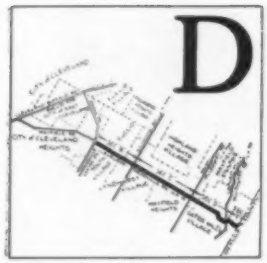
Refuse from the floor of the reservoir, swept up in the cleaning preceding the laying of the 6-inch foundation course, was removed by hand shoveling into a concrete buggy affixed to a skid, which was hauled up the inside slope of the reservoir by a Clyde hoist.

The work was handled under the jurisdiction of the Cambridge Water Board, James J. Scully, Chairman; L. M. Hastings, City Engineer, and Charles E. Price, formerly of the Catskill Aqueduct staff of the New York City water supply, as Chief Inspector.

The Cleveland-Mayfield Road

By Col. Robert S. Beightler

Chief Engineer, Bureau of Construction, Department of Highways and Public Works, Ohio



DUE to the unusual method of financing State Highway projects in Ohio, whereby the County in which a particular project is located cooperates with the State in financing the construction, individual paving projects are usually smaller in size than in many States where the entire cost is assumed by the State. For this reason the subject of this article will not be considered unusual in size in many localities.

One of approximately twenty-five projects of considerable size in Cuyahoga County in which the State of Ohio is paying a portion of the cost, made necessary by the rapid expansion of the City of Cleveland and outlying suburbs, was let August 13, 1926, and known as the Cleveland-Mayfield Road. The contract was awarded to The Dorsey Construction Co., Findlay, Ohio.

Bids were taken on three different types of construction, with estimates as follows:

4" Brick on 8" concrete base, estimated cost	$1,097,812.07
4" Sheet Asphalt on 9" concrete base, including hillside brick on steep grades, estimated cost	1,006,942.99
10" Reinforced concrete pavement, increased to 13" at inside edge (estimated cost)	830,101.56

Low bids on the several types were as follows:

Brick	$890,932.15
Sheet Asphalt	789,544.45
Reinforced Concrete	771,866.32

The award was made on the concrete type. The unit bid price for the pavement was $3.40 per square yard, which at first glance might seem high. When it is considered, however, that the pavement is three inches thicker than the ordinary construction in this State, together with the fact that labor and material prices are somewhat higher in the vicinity of Cleveland than elsewhere in the State, an analysis of this figure will show it to be about the average price for concrete pavement in Ohio.

Design Data

The total length of the project was 7.7 miles. For a distance of 5.9 miles the improvement consists of two 18-foot strips with a 22-foot space between slabs. This section has a raised sandstone curb on the outer edge of each 18-foot strip. The remaining distance of 1.8 miles has a single strip of pavement of 24 feet and 32 feet widths, all of which is through the village of Gates Mills. Raised granite curb was used on all grades of 8 to 10 per cent on the 1.8 mile section.

The thickness of the concrete on the double strip section was 10 inches increased to 13 inches in the outer 2 feet at the inside edge. The depth of the single strip section was variable as it was placed over an old pavement.

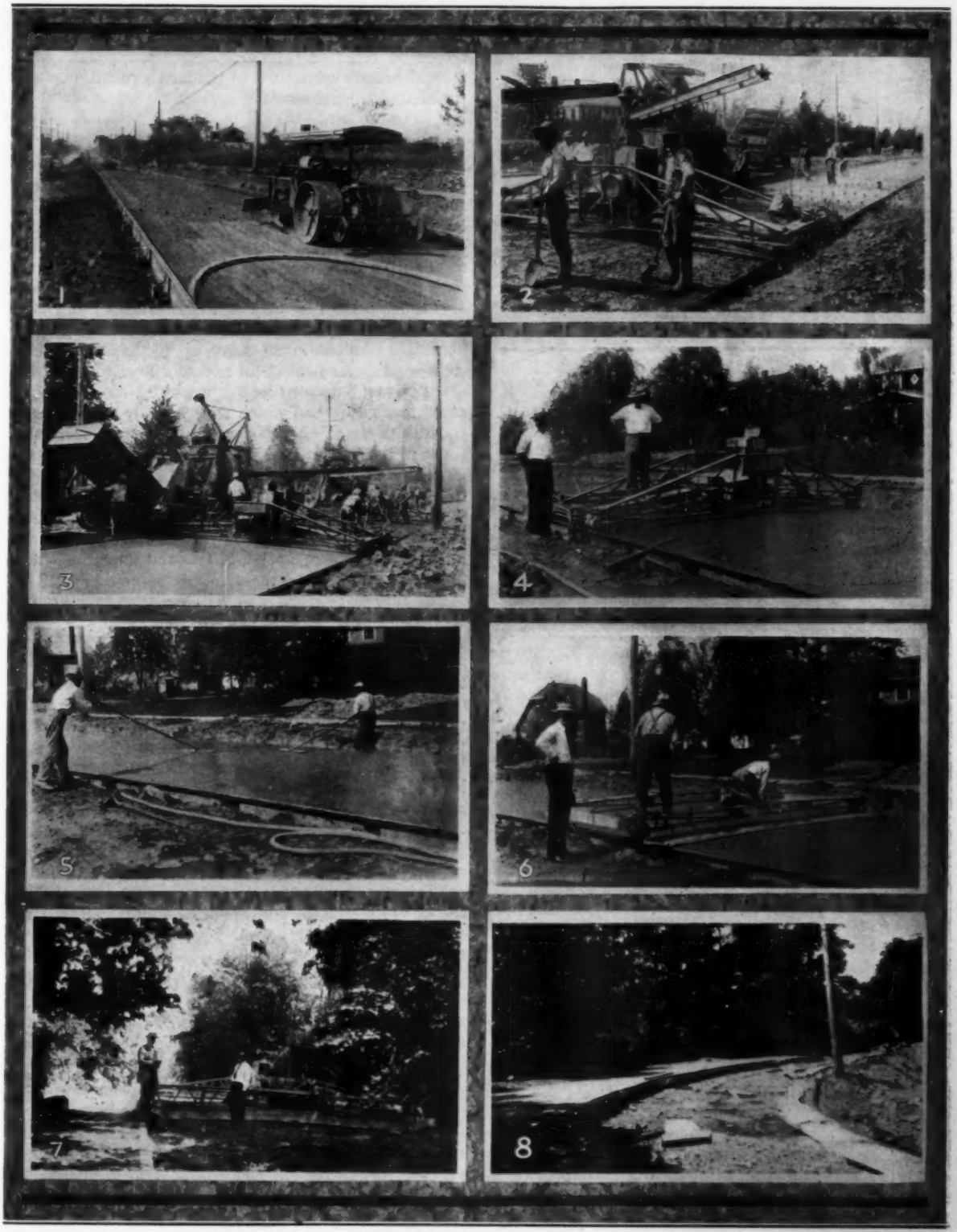
Reinforcing Over Sewer Trenches. Note the Two Mixers, One of Which Placed All Concrete Up to the Steel and the Other the Top Two Inches

The concrete was reinforced with mesh fabric having an effective weight of 56 pounds to the 100 square feet, which was placed 2 inches from the top. Over all water and sewer trenches, most of which were recently excavated, an extra depth of 3 inches of concrete was placed together with extra reinforcing of ½-inch round bars spaced 12 inches center to center. Along each edge a ¾-inch round shear bar was placed.

Slag from the McKinney Steel Co., Cleveland, was used as the coarse aggregate, and lake sand as fine aggregate. The proportions used in the mix were 1:5, or approximately 1:2:3. Frequent tests for sand bulking and concrete yield were made, with the result that the contractor used an excess of cement over the 6.75 sacks to the cubic yard which is the minimum requirement for paving concrete under the Ohio specifications.

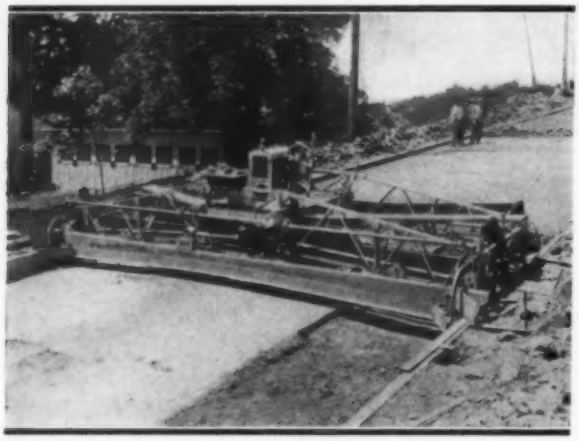
Preparing the Grade

Two steam shovels, one Osgood and one Erie, and



CONSTRUCTION SCENES ON THE CLEVELAND-MAYFIELD ROAD

1. Light roller with scarifier and scratch template repairing subgrade. 2. Placing mesh 2 inches below top of slab, one mixer placed concrete below this plane, second mixer placed top 2 inches. 3. The job was well equipped with machinery, note the two mixers and two finishing machines. 4. Lakewood screed and finishing machine with Engineer Davis and Inspector Bing. 5. Hand finishing with long handled float just before final belting. 6. Final belting with Colonel Beightler, the author, at the left. 7. The 24-foot Lakewood finisher, note the tamper 6 inches below the curb grade. 8. Curve showing concrete placed 2 feet thick for superelevation



This 24-Foot Finisher Was Used to Finish Below the Raised Curb on the Maximum 10.8 Grade

one Osgood gas shovel were used in the grading of the double-strip section. The rough shovel grade was then shaped up with an Adams grader pulled by a 5-ton Caterpillar tractor, and rolled with a 10-ton roller. After the rolling a form subgrader was used followed by a 5-ton roller. Just before placing concrete a scratch-templet of standard design was used to insure a uniform subgrade.

PLACING CONCRETE

Two Foote mixers were employed in the placing of concrete on the double-strip section, one 27-E and one 21-E. Two Lakewood finishers of the screed type were used. The pavers were operated from the unpaved 22 feet in the middle of the road, being equipped with specially made long booms for placing the concrete. This arrangement was an excellent one, as it permitted both the pavers and trucks hauling materials to be kept off the subgrade.

The 27-E paver placed the concrete to within about 2 inches of the top where it was struck off by one of the finishing machines. This was followed by the placing of the mesh fabric and then the additional concrete with the second mixer a few yards behind. The second finishing machine followed. The usual time intervening between the placing of the bulk of the concrete and the top 2 inches was about 10 minutes.

On the 24-foot section another 21-E paver was used together with a specially built 24-foot Lakewood finishing machine. On account of the exceptionally steep grades a very dry mix was used to prevent the concrete from slumping. The result was a remarkably smooth surface.

The finishing machine ran on the granite curb with the strike-off 6 inches below the top of the curb. This machine was arranged so as to tamp and screed the concrete below the top of the curb. To provide a smooth track to run on specially designed angles were fitted on the curb. A smooth finish on this section was secured by using a 3-inch iron pipe, 14 feet long, as a roller. Ropes were attached at either end of the pipe to eye-bolts which were placed so that the pipe would roll when pulled back and forth. It required 4 men to operate it. The weight of the pipe was sufficient to pull forward the excess water and laitance, at the same time filling the voids in any dry concrete. It also disclosed any rough places in the surface which were corrected by repeated rolling.

Steel brooms were used to produce a rough, non-skid surface, with good results.

HANDLING OF MATERIALS

The cement was stacked along the road off the subgrade and carried direct to the mixer. The sand and slag were trucked from the source of supply to the batching plant near one end of the job. Here the materials were dumped into separate pits and placed by means of a clamshell into the batch hoppers. Stock piles of the aggregates were made to insure continuous operation and to take care of all materials as they were delivered. The successful method of handling these materials resulted in no delays in the placing of concrete whatsoever because of any shortage.

City water was used on this work, hydrants being located along the road which runs entirely within incorporated villages. Because of low pressure at certain times of the year, a 10,000-gallon storage tank was provided by the contractor. A considerable gallonage of water was used daily, inasmuch as the Ohio specifications require curing by wet earth or straw which must be kept in a moist condition for ten days. This fact, together with the operation of two and sometimes three mixers, at times taxed the available supply.

The rate of progress was very uniform and satisfactory. Although the contract was let in 1926 the actual paving work did not start until April 25, 1927. Shortly after the contract was awarded an injunction suit held up the work until some time in October, when the contractor started his rough grading and drainage structure work. The placing of the pavement, a total of 15,979 square yards, most of which averaged over 10 inches in thickness, was completed on October 5, 1927. No phenomenal record was made but the uniform progress resulted in the pavement completion prior to the date limit set.

Because of the unusual design and the varied widths of the pavement it is difficult to compare it as far as speed is concerned to other projects. The largest day's run of 915 feet is the equivalent of approximately 1,175 feet of the usual design of concrete pavement laid in this State.

QUALITY

The concrete has consistently shown exceptionally good strength. Concrete cylinders were made and tested frequently with the following averages:

7	days	2,420 pounds per square inch
14	"	3,827 pounds per square inch
28	"	4,582 pounds per square inch

Transverse tests of concrete beams were frequently made on the work and showed an average modulus of rupture for 14-day-old concrete of approximately 715 pounds per square inch.

Cores were cut from one side of the pavement and tested. An average compressive strength of 5,030 pounds per square inch for concrete averaging ninety days in age was attained, which is above the specified requirements and very gratifying to the engineers in charge of the work. The thickness of the cores also indicated the concrete to be uniform in depth with an

average thickness slightly in excess of that specified.

EXCESSIVE LAITANCE

One of the most serious problems presenting itself during the construction was in the matter of eliminating the excessive amount of laitance and water which appeared on the surface. The method of placing the concrete with two mixers aggravated this condition, which continued regardless of the amount of mixing water used. The usual experience in this state with slag concrete has been that the concrete should not be mixed as dry as with stone or gravel as an aggregate. This is due to the porosity and consequent absorption of the slag. On this project, however, the slump was reduced to approximately three-fourths of an inch.

Several methods were tried to secure the results desired on the surface. A roller was used with only fair results. A light water spraying of the surface was tried and seemed to remove the inert material fairly well, but required considerable hand scraping afterward. The final method used contemplated less working of the concrete with the finishing machines, dryer concrete and somewhat more scraping. No weak top crust or scaling has as yet appeared on the surface of the pavement.

CURVES

When the old pavement was constructed years ago no provision was made for superelevation of curves. Consequently on that portion of the pavement where the new pavement was built on top of the old, it was necessary to build up on curves with concrete. The result was that at a few points the slab is over 2 feet thick.

CONSTRUCTION UNDER TRAFFIC

With the exception of the long steep hill in Gates Mills village, the pavement was constructed without any obstruction to traffic. The design of the pavement made this problem a simple one.

SMOOTHNESS

There is nothing exceptional as far as the smoothness is concerned, for all concrete roads now built in Ohio have to meet the same requirements in this respect. The contractor rubbed down all high spots with carborundum bricks within twenty-four hours after the concrete was laid.

FINISHING

The contractor built cross-overs last, as they were omitted in many cases during the main pavement construction so as to cause less inconvenience to traffic. The berms and center strips between the two 18-foot slabs were finished at the same time. The entire project was accepted November 21, 1927.

The following engineers played important parts in the construction of this project: T. S. Brindle, Division Engineer; H. P. Chapman, Engineer Inspector; Daniel Davis, Resident Engineer Inspector; F. R. Lander, Resident Engineer; Jim McCleary, Assistant Resident Engineer, and James Byng, Inspector.

The work has been satisfactory in all respects and the contractor and engineers in charge are to be highly commended for the high class construction resulting from their painstaking care.

Standardization of Replaceable Cutting Edges

Proposed Simplification of Blades for Grading Machines, Road Maintainers and Steel Drags Investigated by U. S. Department of Commerce

THE Division of Simplified Practice of the U. S. Department of Commerce has issued a review of an investigation into the advisability of adopting a simplification and standardization of replaceable cutting edges for grading machines, road maintainers and steel drags. This investigation was prompted by an inquiry which the U. S. Bureau of Public Roads received from the Missouri State Highway Department suggesting this standardization. Inquiries made among the several state highway departments and also the various manufacturers of this class of road machinery brought replies from 41 states and 76 manufacturers, distributors, industrial users, etc. The state highway departments were practically unanimous in their desire to see this simplification accomplished. Of the manufacturers, 29 were definitely favorable to the proposal, 11 favored it "in principle," and only 3 were doubtful or opposed. The 26 not interested are not making products of this kind.

The answers received from the states show that simplification would greatly facilitate the situation, both from the buyers' and the manufacturers' angles and would do away with confusion, delay and expense. Some states have evolved their own standards and are specifying them in their purchases. One says that it has found that "almost any road machine company can furnish blades for any other machine made, and that the manufacturers of the machines themselves do not undertake to make all the cutting edges, but buy them from a few blade makers." One state advises the standardization of blades for each of the following classes of equipment: truck blade attachments; one-man tractor graders; and heavy graders. Another state says, "there is no reason why an 8-foot cutting edge should not fit any 8-foot road machine. The principal matter is the standardization of the spacing, dimension and position of the bolts and bolt holes. This would also standardize the cutting edges for snow plows." Still another state cites the expense of carrying a large stock and also the extra freight and express charges for emergency shipments even with this large stock. Several emphasize the savings in time, inventories, money, etc., that will come out of this standardization.

MANUFACTURERS APPROVE

Typical excerpts from favorable replies by manufacturers are: "There is little doubt that this standardization could be accomplished if the full cooperation of the road machinery manufacturers were enlisted and could be obtained." "This standardization would effect a most desired economy. Present variety is wasteful in production, also in the matter of supplying the trade." "Standard center to center punching of holes if adopted will eliminate much inconvenience and confusion in getting proper repairs in a hurry." "Heartily in favor. We could carry blades in stock all punched ready for shipment. We could carry relatively smaller stocks, give better service and save time and money in our shop."

From the distributors, the following replies are typical: "We could carry a more complete stock, which would not run into half the present investment and give several times better service." "This standardization would be a boon to the industry." "A certain price list shows 593 different blades for road maintainers alone. The six features of cutting edges are length, width, thickness, shape, punching and material. Each is sus-

ceptible of some degree of simplification and standardization."

A reply from an industrial user says "This standardization would be of most practical benefit to those owning graders."

SLIGHT OPPOSITION

The gist of the replies in the doubtful or opposed classification points to the practice of purposely having blades of different punchings to prevent blades of lesser quality than the maker's own standards being put on his machines, for when inferior blades are thus used, the equipment maker's product is blamed for unsatisfactory results. It is also pointed out that individuality in design requires the equipment owner to call on the original manufacturer for his spare parts, and thus prevents the spare parts business going elsewhere. The carrying of present blades to fit machines in use plus blades of new or standard type would increase inventory investment and thus be away from the purpose of simplification. Also, the difficulties of securing agreement on the best type or contour of the blade are very great. The cost for adopting standards is also regarded as prohibitive.

OPPOSITION ANSWERED

The Division of Simplified Practice has made the following answers to the opposition: "Our experience with 80 simplifications to date is that simplification and standardization of size and dimension does not reduce quality but instead advances it. When goods are made in great variety but in small quantities of each, defects and other imperfections are often overlooked, or, if known, are regarded as insignificant. When fewer varieties are made in larger quantities, these faults or defects are apparent in greater number, and hence take on new aspects. New interest develops in them, and effort is made to overcome or eradicate them. Processing is improved and quality is raised.

Two Feet of Excavation Being Handled by a Galion-Cletrac Motor Grader for the Foundation of a New Building 90 x 340 Feet for the Galion Iron Works and Manufacturing Co., Galion, Ohio

"Likewise, since the producer wants to increase his business, he seeks to put the best values he can into his product, and since simplification helps reduce his manufacturing and distributing costs, he has a larger margin between current cost and selling price that often enables him to use higher quality of raw material.

"While it is recognized that machines now in service will have to be supplied throughout their useful life, manufacturers have solved this problem by dividing their stocks into three parts: parts applying to new production only; service parts for previous models; and obsolete parts, or those for which the demand is so slight that it is not worth while to carry them in stock.

"While it may seem that inventories will be increased, by the adding of the new standard blade, it is possible by eliminating items as indicated in the last two parts above, to actually effect a net reduction in the inventory.

"The volume of orders will not decrease. Certain states are now making their own blades, and others may do so to get away from present troubles. The more they do this, the less spare parts business the manufacturers will do. Because of diminishing volume, manufacturers probably will raise their prices to cover the extra costs of making and carrying large variety and small quantities of each. Such prices will react on the buyers who will continue to buy what they want where they can get a reasonable price. If prices are not raised, profits in spares may vanish, and even cut into those profits normally made on new product sales."

ACCORD NECESSARY

Securing agreement is always the big problem in simplification. It is largely a matter of willingness to cooperate, to submerge self-interest to the degree necessary to secure the result that means "the greatest good to the greatest number." In many cases, manufacturers have done far more business after simplification than before. The standards to be promulgated are determined and developed by the industry and its customers. The Department of Commerce endorses them and cooperates in securing their widespread acceptance, application and use.

PROCEDURE

Methods of procedure for the adoption of standardization have been suggested as follows: a preliminary conference, with the Division of Simplified Practice, of representatives of the groups concerned, including American Association of State Highway Officials, Road Machinery Manufacturers Association, American Road Builders Association, U. S. Bureau of Public Roads, and other organizations as their interest may appear. Set up a committee to review current practice and undertake preparation of a tentative simplification program. Submit the tentative program to Division of Simplified Practice as the basis of a later and *general conference of all interests* to review the proposal and adopt it if possible. Appoint a Standing Committee to sponsor simplification as adopted. Endorsement by Department of Commerce. Publication and distribution. At the end of one year, check up the extent of application and use and determine the revisions needed, etc. This is done by the Standing Committee and with the aid of the Division of Simplified Practice. Re-affirmation or revision, also modification of design or inclusion of new and advanced design where circumstances justify such action. Continuing cooperation and support of the Department of Commerce in making the standards effective.

Safety in Ditching

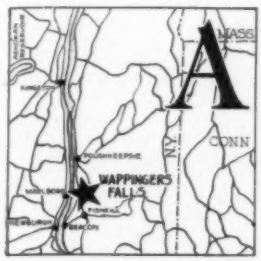
IN a recent talk before the Pacific Coast Safety Conference, George Hess, Vice-president, Thomas Haverty Co., Los Angeles, Calif., told the following story to illustrate carelessness on the part of laborers on excavation projects:

"To be buried alive is indeed an unpleasant way of ending a man's existence. During the construction of a sewer, we had ditches 30 to 35 feet in depth and cave-ins were prevented by means of braces and sewer packs. On this job we had a young Mexican whose duty was to remove the packs and timbers during the process of backfilling. It was customary to remove the lower sets of packs first, then three or four feet of dirt were backfilled, then the next layer of jacks from the bottom was removed and more dirt was deposited in the ditch and so on until all the jacks were removed. The timbers were pulled by cranes. On this particular job, the banks appeared to be as strong as brick walls and this young fellow, who had worked on the job for many months doing this particular work, started to remove the top jacks first. The earth then caved in and when we took him out late one Saturday afternoon he was standing on the row of jacks below with his head crushed and with the jack that he had just removed still in his hand."

A very conservative estimate places the hidden loss from accidents at a figure at least double the cost of insurance. It is also four or five times the cost of compensation insurance.

5.4 Miles of 3-Strip Highway

Spoor-Lasher Company Builds Highway Rapidly With Well-organized Labor Units and Well-chosen Plant



AN UNUSUALLY well-organized concrete paving project has been under way in New York State this last construction season near Poughkeepsie, between Wappingers Falls and the village of Fishkill. This section is on U. S. Highway 9E and is a portion of the main thoroughfare from New York City along the east shore of the Hudson River. The work has caused many motorists to detour and hence suffer some delay, but the detour was in fair condition and did not cause the damage, mental and material of other detours.

Central Proportioning Plant

The Spoor-Lasher Co. of Poughkeepsie, N. Y., contractors for this section, established a well-equipped central proportioning plant at New Hamburg, N. Y., on the shore of the Hudson River about two miles south of the project. This was the nearest point where satisfactory dockage facilities could be created. Sand was brought in by barge from the Rosoff Sand and Gravel Co. plant at Marlboro, N. Y.,* about two miles upstream from New Hamburg and across the river, which is about 1½ miles wide at this point. Stone was barged upstream about 15 miles from the quarries of the Tomkins Cove plant of the New York Trap Rock Co.

Both sand and stone were unloaded by a crawler-mounted Erie crane with 40-foot boom and Hayward bucket. Cement was also brought in by barge in sacks and unloaded by a small hand derrick and the sacks moved to storage or to the cement sack conveyor by Barrett-Cravens hand trucks. The sand and stone were loaded into the Blaw-Knox bins or to ground storage if the bins were filled. The bins were equipped with batch boxes, which quickly loaded the Mack trucks as they drove under the bins. The trucks then drove to the shed where the cement was added. The cement was run up a conveyor as needed, direct from the hand trucks to a small storage platform, from which the bags were emptied into the batch boxes. When the platform was filled the bags were stored in the cement shed as close to the conveyor as possible. A Unit sack cleaner and baler were a part of the equipment at the proportioning plant. A small Fairbanks-Morse reciprocating pump on skids was mounted near the edge of the unloading dock and was used to supply Hudson River water to the Erie steam crane.

Construction Equipment

As the speed with which any concrete road project makes progress is dependent on the delivery of materials the contractor not only used his own fleet of Mack trucks with Wood horizontal hoists and bodies holding two batches, but also rented a large number of similar trucks from other local hauling contractors. In addition, great care was taken to see that the subgrade was prepared well in advance of the paver and a special Foreman Grader, G. C. Jones, saw to it that the work was properly handled. Two Buffalo-Springfield rollers were kept busy rolling the subgrade, one a steam tandem roller and the other a converted 3-wheel steam roller now operated by a Waukesha motor. On preliminary subgrade an Austin motor grader with McCormick-Deering tractor was used to shape up the grade and to spread the material dumped for fill. The roller followed to compact the work and later, before the final rolling, a laborer with a scratch template carefully tested the subgrade for high and low spots. This is an important work, as many a contractor has lost a considerable yardage of concrete by having his subgrade low. In states where core tests are made of the completed work the contractor is likely to suffer a reduction in his final estimates if the specifications as to thickness are not fulfilled.

Specifications

The specifications for this job called for a 1:2:3½ mix. The job was let in the early spring of 1927, when the state highway specifications called for expansion joints every 40 feet. The contractor ordered his Elastite expansion joint on this basis. After the spring conferences of the Division and Resident Engineers and the office staff, it was decided to change the specifications and place the expansion joints every 78.5 feet. In order to have this specification incorporated in the Spoor-Lasher project and still not have the contractor lose money on the expansion joint ordered, he was permitted to use two strips of expansion joint every 78.5 feet to make up for the difference in his original and revised specifications.

No admixture was used on this job and curing was by the straw cover method. The rapid advance of reinforcing methods is shown by the adoption of the Bar-Mat type of reinforcing which saves the cutting of the reinforcing from rolls and the need of straightening and also overcomes the large labor item when reinforcing rods are tied on the job to form the mats as was the case only a year or two ago on New York State contracts. These mats are suspended on channels spanning the forms and arranged to release the mat by lifting a handle at the side. The mat is released as soon as the concrete deposited is at a sufficient height to support it.

Concreting Plant

Forms were set to accurate grade soon after the preliminary subgrade was completed. A Y-shaped gage was used to insure the correct width of slab. Following this

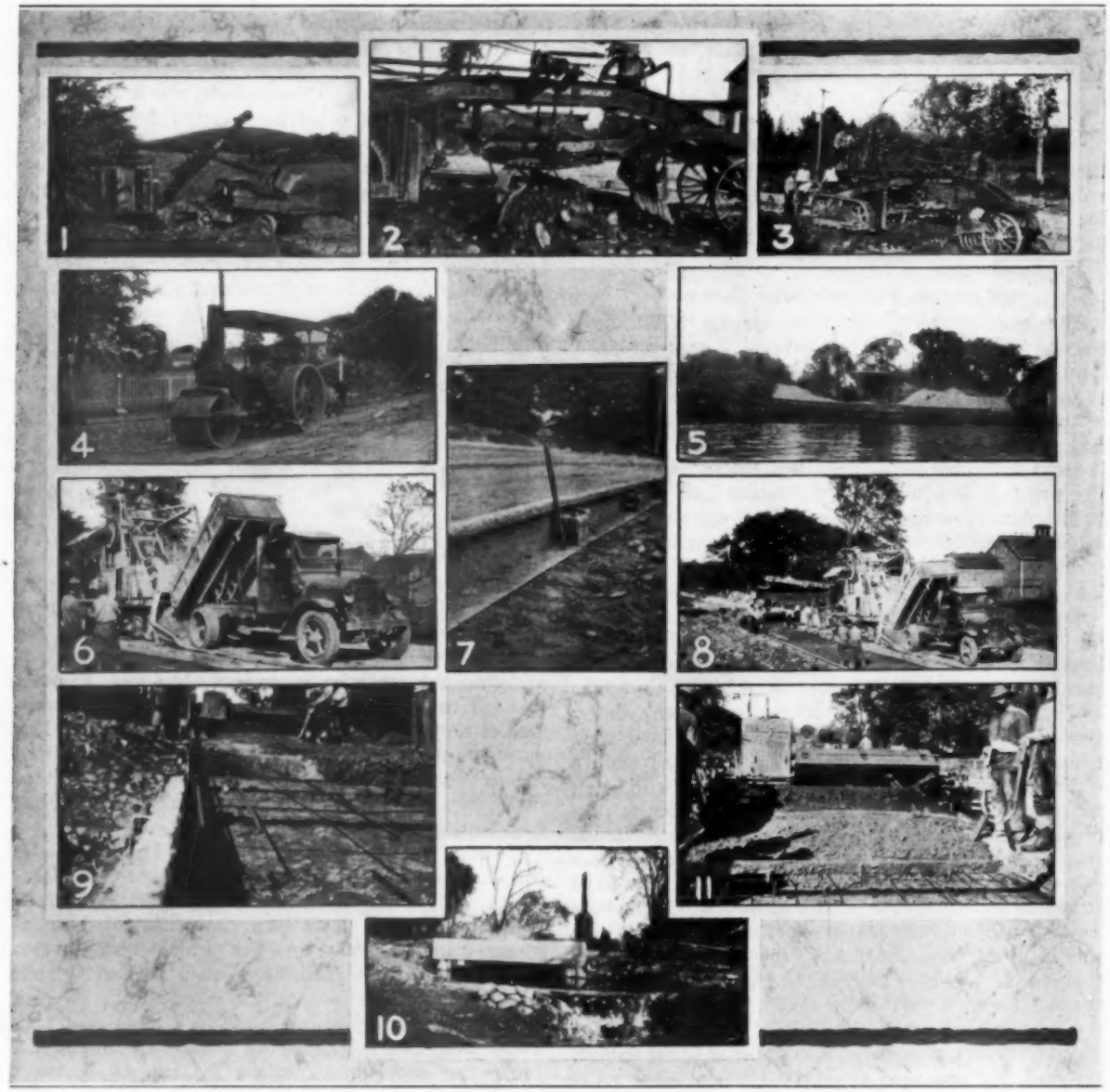
* This plant will be described in the February issue of Contractors and Engineers Monthly.

the final subgrade was tested, corrected and rolled and the pouring commenced. In order not to injure the subgrade in any way, the Koehring 27-E paver was operated from the subgrade or slab adjacent to the one being poured and was run on planks. The trucks were likewise kept off the subgrade and run up to the mixer on planks. The mixer towed a bib or apron behind it to catch any fresh concrete that might drip from the bucket as it ran out the boom or on its return and thus mar the appearance of the cured slab on which the mixer was running.

A reciprocating steam pump located about midway of the project was used to supply water through a 3-inch wrought iron line to the mixer. The pump was located at a culvert constructed as a part of the project and in order to insure sufficient water storage a very effective dam was built of bags of sand.

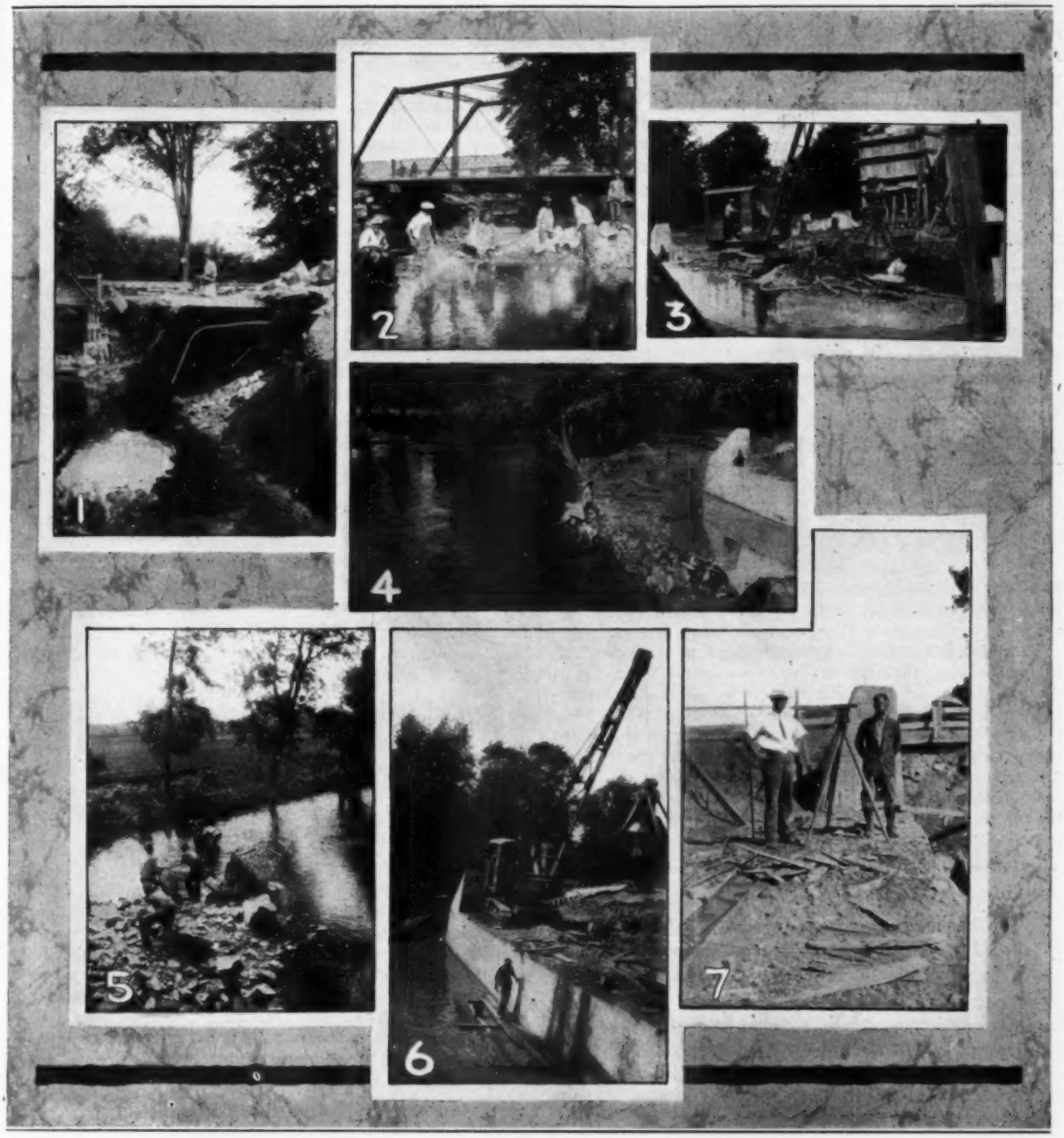
SOUTH END OF PROJECT

Grading began in September for the 1928 portion of this project. The work involves several cuts to eliminate curves and some fill across a low section of somewhat swampy character. The nearby cuts being of a rocky nature provided excellent fill for this work.



SCENES ON THE WAPPINGERS FALLS–FISHKILL SECTION OF THE ALBANY POST ROAD

1. Erie shovel loading Mack truck on grading operations. 2 and 3. A close-up and complete view of the Austin motor grader with McCormick-Deering tractor which was used to prepare the subgrade. In this picture, it is spreading fill brought in by the motor trucks. 4. Buffalo-Springfield roller rigged with Waukesha motor at work on subgrade. 5. The central proportioning plant at New Hamburg, N. Y., on the Hudson River. 6. Truck delivering batch to the Koehring mixer. 7. Steel road forms, showing method of staking to brace the form against pressure of the finishing machine on the inside of superelevated curve. 8. Another view of the mixer. 9. Method of supporting reinforcing to hold it in proper position in road slab. 10. A typical culvert showing a dam of cement bags in the foreground to form pool for pump. 11. The finisher at work.



BUILDING THE NEW STATE HIGHWAY BRIDGE AT FISHKILL, N. Y.

1. Excavation for foundation of new bridge, showing temporary abutment with old truss in background. 2. Men transferring lumber across the stream to start erecting forms for the south abutment. 3. P & H Model-300 crane with Williams bucket, which handled the excavation for the abutments, as well as loading the aggregate bin shown in the background. 4. The north abutment, showing the earth yet to be excavated to widen the stream channel. 5. Bridge crew hauling small water pump through the stream. 6. The P & H crane excavating to grade, behind the abutment. 7. At left, R. G. O'Connell, Engineer in Charge, New York State Highway Department, and on right, C. Hsu, a Cornell student, who worked on this job during the summer vacation

Ingersoll-Rand compressors operating jack hammers of the same make made short work of the rock. After blasting, the rock was loaded into 5-ton Mack trucks by an Erie steam shovel. The trucks dumped as near the edge of the fill as was safe and a Caterpillar Thirty tractor with a LaPlant-Choate bull-dozer spread the rock and dirt to the proper section. By continual driving over this fill it was well compacted before the roller arrived for final compaction.

The Ingersoll-Rand compressor mentioned above was a 10 x 8 unit operating at 100 pounds pressure. It was mounted on a Mack truck which carried the drill steel for a day's work in two racks on either side of the truck.

BRIDGE ACROSS FISHKILL CREEK

The Albany Bridge Construction Co. is the subcon-

tractor for the piers, and a steel truss bridge, 144-foot span, across the Fishkill Creek as a part of the project. A P&H Model-300 crane with a Williams bucket was used to handle the excavation for the piers. To unwater the sheet piling open caisson, two Novo diaphragm pumps were used. The mass concrete for the piers was mixed by a Koehring Dandie mixer supplied with aggregate from a bin filled by the crane. The roadway across the bridge will be 40 feet wide with curbing, and a 7-foot sidewalk on the right only. The raising of the steel was commenced on November 2, 1927, using a National hoisting engine and a "Jennie Winke" derrick. The steel was furnished and fabricated by the Bethlehem Steel Co. Riveting of the structure began on November 16. The heaviest member weighs 6½ tons. The accompanying illustrations show the equipment and some interesting episodes on this part of the project.

Accidents on Public Utility Properties

"THE politicians have taught us to shout 'safe and sane,' but neither they nor we have done much about it. We counsel caution, then praise daring men who have won by taking a chance. We insist on speed and economy and hope for carefulness. This is true not only of contractors but all of us; they are neither better nor worse than we."

Thus J. C. Sanderson of the engineering firm of Sargent and Lundy, Chicago, Ill., expresses his views on contractors' accidents in the construction industry. He feels that the responsibility of unnecessary accidents is not with the individual alone nor any one group. Some responsibility for insistence on undue speed must be undertaken by the owner; the accident insurance companies are responsible for being financially interested in the undertaking without a representative on the job; the contractor for not properly organizing his prevention measures; and the individual for his carelessness.

"Any material improvement must come through intelligent and experienced foremen. Each foreman should be charged with the protection and training of the men under him. The foreman should be held in some measure to blame for all accidents to his men. There should be a bonus system or some form of special recognition for foremen that have their men well trained. Handling materials accounts for about 40 per cent of the accidents. This percentage could be materially reduced by teaching the men the proper way to handle materials and then insisting on the proper method being used."

With the rapidly growing demand of the consumers for a higher grade of service, greater reliability and lower rates, the utility companies can only meet this condition with speed and efficiency. And, as the number of accidents resulting therefrom increases, the premium rates charged by the insurance companies are increased, and the owner pays.

"The accident insurance companies should require certain protective measures before insurance is granted. They should, from their records, be able to convince the contractors that intensive accident prevention is economical. At the end of each contract the insurance companies should send to the contractor a tabulation of all accidents with the causes and recommendations for prevention. It would be profitable for both the insurance companies and the contractors if the foremen's interest in accident prevention could be quickened. It will be through the efforts of the foremen, with their records, that the greatest reduction in the number of accidents will be accomplished.

"It is not difficult to demonstrate that the jobs which are best organized for safety are also best organized for speed and economy. In theory, all large contractors are strong for safety measures; in practice, their safety rules are not strictly enforced."

The following have been suggested by Mr. Sanderson as rules which should be followed in this industry: the master mechanic to make a careful daily inspection of all equipment, reporting daily on its condition; all derricks to have extension levers affording the operator unrestricted vision; all rubbish to be piled outside the area of activity as soon as it accumulates; definite traffic lanes of travel, out of range of derricks and other moving equipment, should be established; proper stairs, ladders and handrails should be built and properly maintained; all scaffolds, planked areas, etc., to be passed on by the master mechanic; and physical and mental requirements in hiring men should be raised and exacted.

The mental attitude of the men accounts for about 60 per cent of all accidents. This may be divided as follows: poor judgment, 30 per cent; contributory negligence of others, 10 per cent; haste, 10 per cent; and inattention, 10 per cent. Improvement will be slow and it will come only by formulating a comprehensive set of rules for taking care of equipment and laying out work, and a systematic method of training foremen in safe methods of handling their work and they in turn teaching these methods to the men under them.

ACKNOWLEDGMENT: Prepared from a paper read at the Annual Safety Congress of the National Safety Council at Chicago, Ill.

A Spiral Bridge Approach With 32 Years Service

THE Mississippi River Bridge at Hastings, Minn., on State Trunk Highway No. 3 is believed to be the only highway bridge in the United States making use of a spiral bridge approach. This unique structure was built in 1895 and consists of a main span of 380 feet which has a clear height above ordinary water of 55 feet and the total length of the bridge is 1713 feet, including the spiral approach.

Conditions were such at the site as not to permit of a straight-away approach without interfering with the built-up portion of the town of Hastings and at the date that the structure was built high speed traffic was unknown, so the engineer resorted to the scheme of spiraling the approach and thereby not hindering the development of the town. This ingenious approach has served for many years and represents an engineer's solution of a rather difficult problem.

We are indebted to P. K. Schuyler, Associate Professor of Civil Engineering, George Washington University, for this item and illustration.

The Mississippi River Bridge at Hastings, Showing the Spiral Approaches Built in 1895

Material Handling Methods at the Great Northern Cascade Tunnel

By R. F. Hoffmark

General Superintendent, A. Guthrie & Co. Inc., Portland, Ore.

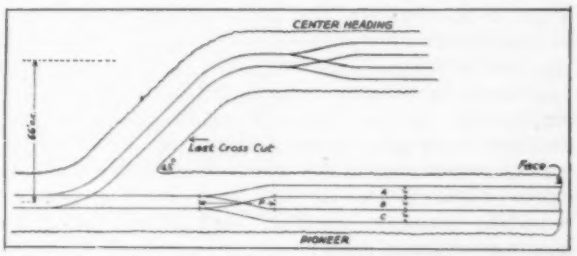
THE high schedule maintained to date in the driving of the Great Northern New Cascade Tunnel is in no small part due to the material handling methods and devices in use on that work. The job has had considerable publicity and most readers are undoubtedly familiar in a general way with the scope and progress. The methods of material handling adopted, and the equipment selected or designed, are, however, so closely related to the physical properties and the time schedule of the job that a description is necessary to establish a background.

The New Cascade Tunnel will be a single track standard railroad section tunnel 7.78 miles from Portal to Portal, and will be concrete lined its entire length before being opened to traffic. It pierces the Cascade range 93 miles east of Seattle, Washington, and establishes a new summit at the East Portal. The entire tunnel is on a tangent; the improvement reduces curvature 1,960 degrees, saves 510 feet in elevation and entirely eliminates six miles of snow sheds, the maintenance and renewal of which constitutes a major operating problem for the railroad management.

In November, 1925, the railroad company awarded the contract for building the tunnel to A. Guthrie & Co., Inc., and at that time a tentative time schedule indicated that the work could be completed in three years, that is, by November, 1928. The problem confronting the contractors consisted of driving and lining 7.78 miles of railroad tunnel in three years.

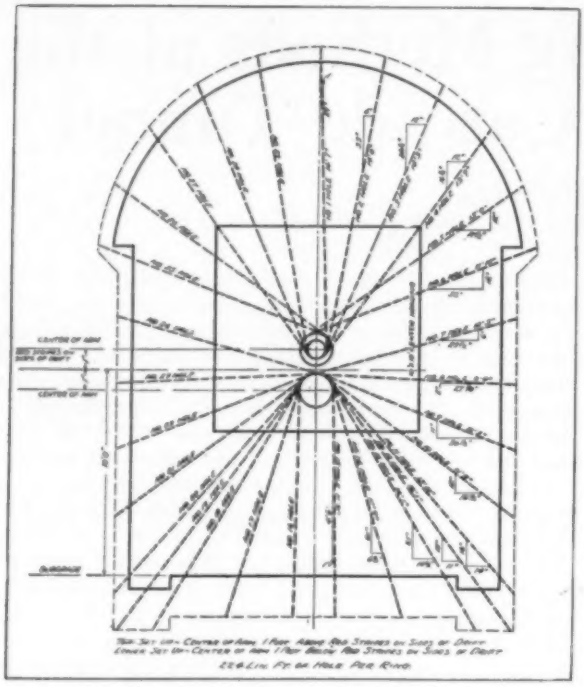
Due to the high speed requirements, the center heading method of driving was selected. A study of profile indicated only one feasible shaft location and the tunnel is, therefore, being driven from both portals and from the Mill Creek shaft, located 2.41 miles west of the East Portal and 5.37 miles east of the West Portal. The location of the shaft makes it evident that the job is in effect divided into two tunnels, one 2.41 miles long and one 5.37 miles long. This was taken into account in planning the work, and before a specific mention is made of excavation equipment and methods, a detailed account of the general method of attack is essential. The center heading method was selected for speed in enlargement operations, and hence speed in completion. With this method, the center heading must be kept well in advance of the enlargement operations as all cleaning, drilling and catching up all soft and crushed areas must be done ahead of the enlargement excavation. In making up the time schedule, it was at once evident that the completion of the project rested directly on the speed attained in driving the 5.37-mile section and that the 2.41-mile section was of secondary importance. For this reason, it was decided to eliminate the pioneer tunnel construction on the short section, driving the center heading west from the East Portal and east from the shaft and delaying enlargement operations until the two center heading drifts met. The center heading then being open from the shaft to the East Portal provided a means of supplying explosives, air, timber, etc., to the East Portal enlargement operations, from the shaft.

Drill Steel Car Ready to Go Under Ground. It Is Placed Directly Behind the Drill Carriage. Note the Extra Drills, Oil Cans, and Extra Hose Connections. The Car Carries Drill Steel for One Complete Round, After Which It Returns to the Drill Sharpening Shop to Have the Drill Steel Resharpened



Trackage Diagram for Pioneer and Center Heading Operations of A. Guthrie & Co., Inc., in the Cascade Tunnel of the Northern Pacific Railway

On the long section the supply of necessary materials and men for the enlargement operations other than excavating is accomplished by the pioneer tunnel and cross cuts. As shown by the diagram, all compressed air, ventilating lines, explosives, equipment, drill steel, etc., is sent to the operating areas by means of the pioneer to a point well ahead of the enlargement shovel and then into the center heading by means of a cross cut, then back by means of the center heading to the point where material is required. By studying the



Ring Drilling Diagram for Cascade Tunnel

chart, it is self-evident that both the pioneer and center headings must have a substantial working lead as well as a lead to take care of emergencies such as bad ground conditions, which may require timbering ahead of the enlargement shovel. The excavating equipment and methods were selected and designed to fit in with the general method of attack and to coordinate with the speed requirements, as set forth by the progress schedule. Progress schedules were made up with the following monthly rates:

West Portal
Pioneer drift, 800 feet per month.
Enlargement, 800 feet per month.
Concrete lining, 1,125 feet per month.
East Portal
Center heading, 800 feet per month.
Enlargement, 800 feet per month.
Concrete lining, 1,125 feet per month.
Mill Creek Shaft
Pioneer, West only, 600 feet per month.
Center heading, West, 600 feet per month.
Center heading, East, 700 feet per month.
Enlargement, West only, 600 feet per month.

Lower speed requirements were set up at the Mill Creek shaft, due to shaft operations and the possibility of encountering water-bearing ground on down-grade operations. Both the West Portal and Mill Creek camps are organized with separate crews for the pioneer, center headings and enlargement. The East Portal in the first stage drove only the center heading, and since the completion of this operation through to the shaft the East Portal has the enlargement operations only. All operations are continuous, three 8-hour shifts every day of the year.

PIONEER TUNNEL OPERATIONS

The pioneer tunnel has theoretical dimensions of 9 feet width and 8 feet height. It is located 66 feet center to center with the main bore and the floor of the pioneer is 7 feet above the main tunnel sub-grade, the floor of the pioneer being the same distance above the main tunnel sub-grade as the floor of the center heading. Cross cuts connecting the pioneer and center heading are in general 1,500 feet apart, varying, however, due to operating conditions as shown on the chart. The equipment used in the pioneer at the West Portal and Mill Creek is identical except that at the West Portal the drills are Denver No. 17 Drifters and at Mill Creek, Ingersoll-Rand No. 72 Drifters. The pioneer trackage is 24-inch gage, 40-pound rail on 5x6 timber ties. From the last cross cut to the face, a 3-track system is used, that is, three tracks with four rails, the two outside tracks each having one rail in common with the middle track. The middle track is used by the drill carriage during the drilling cycle and by the mucker during the digging cycle. The left hand track, looking toward the face, is the loading track and the right hand is the track for empties. In changing from drilling to mucking or vice versa, the drill carriage and the mucking machines pass each other at the nearest cross cut. The three tracks are produced by means of an ordinary wish-bone layout with one switch and frog, as shown on the pioneer and center heading track diagram. It will be noted that both the drill carriage and mucker must reach the single track back of the last cross cut for passing purposes. This is accomplished by a portable 24-inch gage jump section, which extends the distance "F" as shown on the diagram. The jump section is rigid and can be handled by two men; when not in use it stands on edge against the side of the drift. For haulage purposes, a single track system is used between the most advanced cross cut and the portal with sufficient sidings to serve the operations. The equipment for driving the pioneer and center heading drifts selected for adaptability, size and performance is as follows:

Mucker—No. 4 Myers-Whaley.
Drill carriage—Sullivan Machinery Co.
Cars—24-inch gage, 50 cu. ft. capacity, all steel Koppel mining cars.
Locomotives—General Electric 6-ton trolley with gathering reels.
Drills—Denver No. 17 and Ingersoll-Rand No. 72.
Transfer cranes—24-inch gage air operated, designed and built by A. Guthrie & Co., Inc.
Drill steel car—24-inch gage, designed and built by A. Guthrie & Co., Inc.

The cycle of operations in drifting begins with drill-

Marion No. 40 Air-Operated Shovel with Scaling Platform on Top, Showing Method of Loading 6-Yard Koppel Cars

A Myers-Whaley No. 4 Mucker in the West Portal Pioneer Tunnel

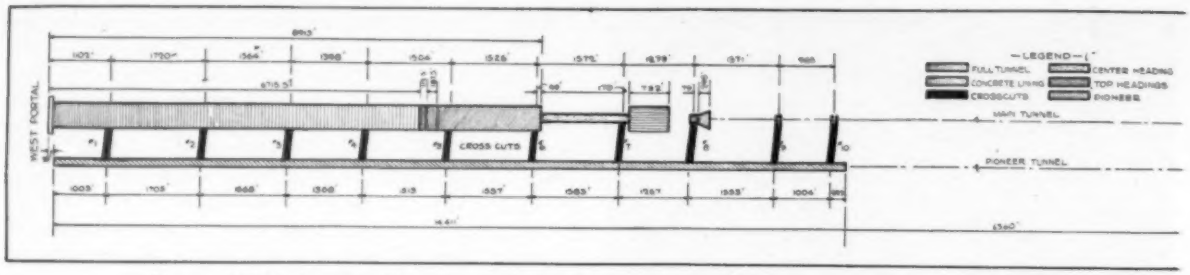
ing. When the face has been scaled, the drill carriage mounting four drills is set up, lead holes are pointed by the shifter and the "Let her go" signal given. Directly behind the drill carriage on the center track "B" is the compartment drill car shown in the illustration. There is no steel on the floor of the drift, as the nipper places the used drill steel in the proper compartment as soon as he receives it from the drill helper. With this drill steel car, there is no confusion due to sorting steel to find the proper length. When the round is completely drilled the drill steel car is sent to the drill sharpening shop, which is served by trackage directly connected to the tunnel tracks. All used steel is re-sharpened for the next round. The drill carriage is taken back to the next cross cut while drillers load and wire the ground. During the loading time, the Myers-Whaley mucker is brought to within 500 feet of the face and left on the center track "B." After the shot, as soon as air conditions permit, the mucker loads cars alternately on tracks "A" and "C" while cleaning up fly rock, the loading belt being shifted from side to side by means of a worm and gear attachment. When the clean-up of the fly rock is completed, the transfer crane comes in on the head end of a string of empties on track "C," and a second motor brings in one car on track "A"; while this one car is being loaded, the crane "swings" the first one of the string of empties and is ready to transfer this car to track "C" as soon as No. 1 is loaded and pulled back. This operation is repeated until the round is mucked out. The crews have become very expert at this operation, and the cars can be transferred in about 35 seconds. The walkers and shifters are instructed to have enough empties available to load out the entire round. The only appreciable delay in the entire operation is when a loaded train leaves for the portal. During the time it takes the loads to reach the first cross cut, plus the time it takes motor No. 2 to reach the mucker on track "A," cars are spotted under the delivery belt by man power, with the aid of the transfer crane, it being remembered that track "C" contains enough empties to load out the entire round. Tracks are advanced during the mucking period by means of built up sections and a permanent track is installed during the drilling period. As many as five complete rounds have been drilled and mucked out in 24 hours and excellent performance by the equipment plus the splendid team work by the crews enabled the pioneer crews to establish such records as 52 feet in 24 hours and 1,157 feet in a single month. The methods and equipment are the same for the center heading crews as for the pioneer crews.

Headframe and Surface Bunkers at the Mill Creek Shaft. The Galvanized Iron Building at the Right Is the Sharpening Shop and the Two Galvanized Iron Buildings at the Left Are the Hoist Houses for Skips and Cage. The Trestle in the Foreground Goes to the Waste Dump

At the West Portal, pioneer and center heading, muck reaches the Portal 7 feet above the sub-grade of the main line; due to the long haul on tunnel muck at the West Portal, all of which is being used for a line change in connection with the tunnel approach, muck is bunkered and reloaded in 6-yard cars, by means of bunkers equipped with finger gates. It is then distributed by means of 20-ton motors and 6-yard cars on 36-inch gage construction tracks. These tracks extend approximately two miles west of the West Portal where the new line joins the present operated line.

The enlargement operations at all camps are accomplished by the ring drilling method, a diagram of which is shown. The drilling is generally carried 300 to

The 24-Inch Gage Air-Operated Cherry Picker for Transferring Muck Cars in Drifting Operations. The Pipe Line at the Upper Left Is a 20-Inch, 18-Gage, Galvanized Ventilating Pipe



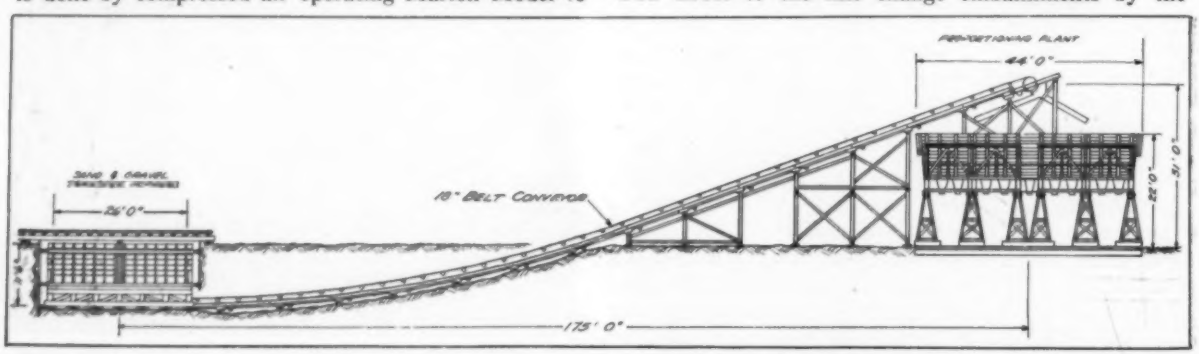
Status of Work from the West Portal of the Cascade Tunnel Going East as of November 1, 1927

400 feet in advance of the shovel and blasting is done by shooting five or more rings at once. The rings are spaced four feet center to center and the bottom is

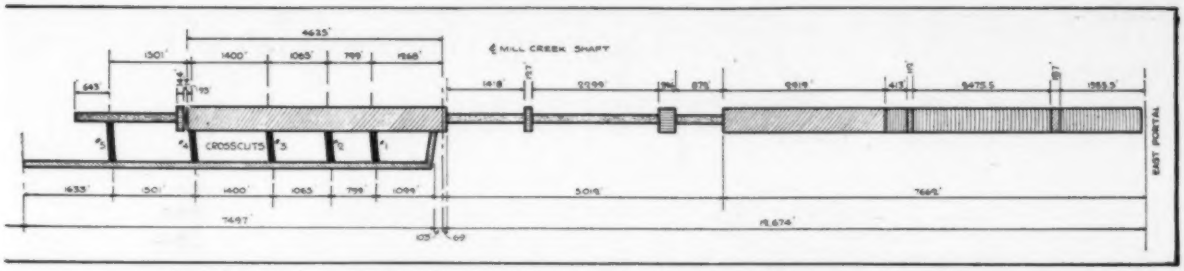
Muck Transfer Apron at the East Portal. This Photograph Shows the 50-Foot, 24-Inch Gage Cars from the Center Heading. The Apron Is Now Used to Dump 6-Yard, 36-Inch Gage Cars into Main Line Cars

shot about 20 feet in advance of the top. The only difficulty experienced is to break bottom in the corners. For this purpose, 80 per cent gelatin is used and the holes are drilled well below sub-grade. The mucking is done by compressed air operating Marion Model-40 railroad type shovels with tunnel boom and dipper sticks. The shovels are also mounted on crawler traction and no jack arms are used. The crawlers are so designed that they straddle the empty car track behind the shovel so that the shovel can back up for the blasts. The compressed air tank on the shovel is equipped with electric heating units, which raise the temperature of the compressed air to such a point that no difficulty is encountered with freezing at the exhausts. All muck haulage is by 20-ton General Electric trolley locomotives, hauling trains of 6-yard Koppel side dump cars. All main tunnel construction trackage is 36-inch gage using 55-pound steel rails on wooden ties. The operation is very similar to that in the drifts, except that a 2-track system is used at the face, one for empties and one for loads. Looking toward the face, the right hand track is for empties and the left hand for loads. The center line of the track for empties coincides with the center line of the shovel and the track for loads extends past the shovel and into the muck pile. The operation is practically what is known as "facing out." One car is loaded at a time. The rear of each enlargement shovel is equipped with an air operated boom, which picks up the empties from the empty track and places them on the load track, while the loading locomotive backs up with the car just previously loaded. Only one locomotive is used for this operation, empty cars being brought up to the transfer boom by means of an air operated drum and cable handled by the transfer hoist operator. The enlargement operations at all three camps are identical, as far as drilling, blasting and loading muck are concerned. The East Portal camp holds the high run record to date of 1,220 feet of completed enlargement during the month of August, 1927. This record includes a number of 60-foot advances in 24 hours.

At the West Portal, the enlargement muck is handled direct to the line change embankments by the



Proportioning Plant Layout, Showing Sand and Gravel Hoppers into Which Material Was Dumped, 18-Inch Belt Conveyor and, at Extreme Right, Proportioning Plant for Sand and Gravel



Status of Work from the East Portal of the Cascade Tunnel Going West as of November 1, 1927

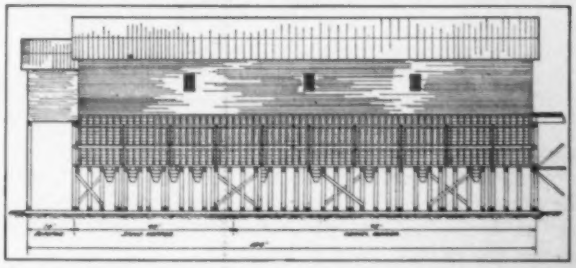
tunnel trains but at the East Portal the tunnel trains dump into 30-yard standard gage cars by means of a dump apron. The Great Northern main line crews then distribute the material for line changes on the present operated line east of Berne.

Muck Train of 6-Yard Cars Hauling to Line Change Embankment from the Pioneer and Center Heading Muck Bunker at the West Portal. The Bunker Is the Structure in the Center Which Receives Muck from the 50-Foot, 24-Inch Gage Drift Cars

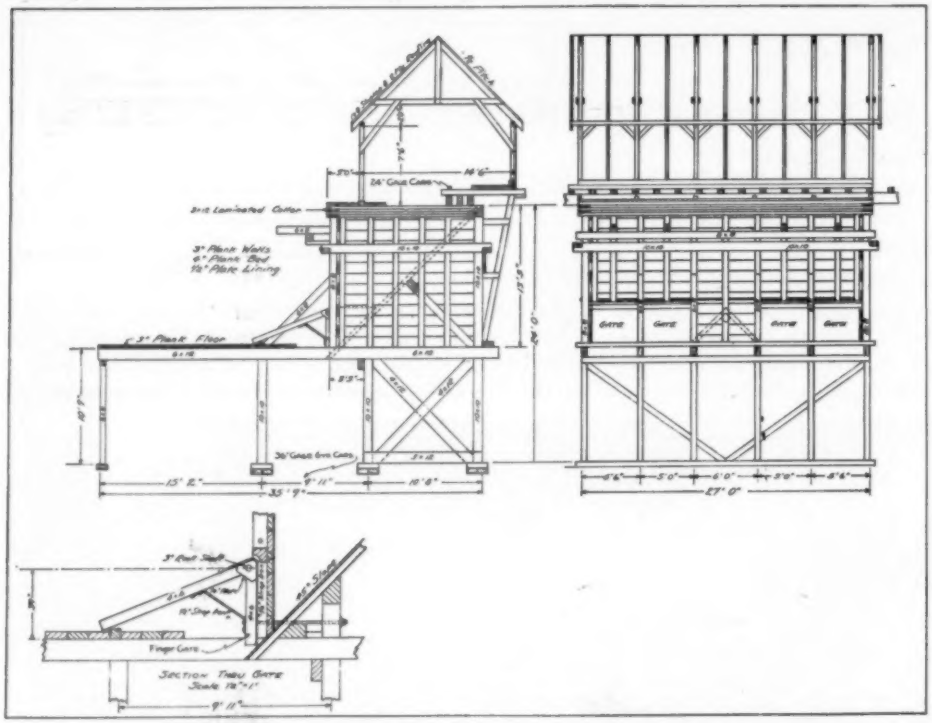
At the Mill Creek shaft camp operations are similar, but in addition shaft operation is necessary to get rid of the muck. The pioneer, center heading and enlargement trains all dump into the same bunker. This bunker extends 37 feet below the sub-grade of the tunnel and is served by two 70-foot Kimberley Skips, which operate in balance and have a line speed of 1,400 feet per minute. These skips dump into surface bunkers, which in turn are emptied by 6-yard car trains and trolley locomotives. All bunker operations are controlled by air-operated finger gates. Because of the location of the shaft, all tunnel muck from shaft operations is wasted.

MATERIAL HANDLING METHODS FOR CONCRETE LINING

All concrete lining will be done by the West Portal and East Portal crews. Sand and gravel is shipped to the work in standard gage bottom dump cars from the Great Northern pit at Reider. Sand and gravel bunkers with storage for 950 cubic yards of gravel and 450 cubic yards of sand were built so that main line spurs went over the top of the bunkers; unloading of main line cars thus being a very economical operation. At the West Portal, sand and gravel is transferred to 6-yard cars by gravity and dumped into a hopper near the Portal, from which hopper it is transferred to the proportioning hoppers by means of a belt conveyor. The proportioning hoppers are equipped with Blaw-Knox sand weighing devices and gravel volume measuring devices. These devices load the Blaw-Knox batch boxes on 36-inch gage flat cars and when the train of batch boxes is loaded, it proceeds to the lining operations. Blaw-Knox steel tunnel forms are used and a



Storage Bunkers and Proportioning Plant, Showing Five Sand Hoppers at Left and Five Gravel Bunkers at Right



Details of Transfer Bunkers of Proportioning Plant

37½-foot section of forms is only one part of the concreting unit. A concreting unit consists of steel forms attached to a structural steel traveler equipped with hoist, mixer, conveyor bucket, receiving hopper, conveyor belt and cement gun. The entire unit rests on Jumbo wheels and straddles the 2-track system used in the main bore. One of these tracks is left open for muck trains and the other is used for the train loaded with batch boxes. The batch box is hoisted and dumped into the loading skip of a ½-yard non-tilting Smith mixer. This mixer discharges into a ¾-yard bucket, which is hoisted on inclined guides and dumps into a ¾-yard hopper. When the side walls are being poured, this hopper feeds concrete onto a Northern belt conveyor and the concrete is removed from the belt into the chutes by means of a strike board, the concrete then flowing in chutes to the side walls by gravity. When the arch is being poured, the hopper feeds into a Ransome gun instead of onto the belt conveyor and the arch is then placed by the pneumatic method. The entire plant, plus 37½ feet of forms, is a unit and moves as a unit. Both the West and East Portal have three such units, the schedule being that one form unit is poured each day. The units are spaced and then start so that each has a long run but when No. 3 reaches concrete placed by No. 2, and No. 2 reaches concrete placed by No. 1, a general move-up is necessary.

At the East Portal, all tunnel operations are near the present operating Great Northern tracks, hence weighing and measuring devices for sand and gravel are placed under the main storage bunker, and no separate proportioning plant is necessary. At both operations, the cement is measured by the sack and each batch box has an individual cement compartment with a lid to protect the cement from moisture.

The entire work is under contract to A. Guthrie & Co., Inc., and for the railroad company is under the direction of J. R. W. Davis, Chief Engineer, and Col. F. Mears, Assistant Chief Engineer. For the contractors the work is under the personal direction of J. C. Baxter, Vice-pres., and W. E. Conroy is in charge.

The major items of equipment are as follows:

Drift mucking machines—Myers-Whaley No. 4.
Drift cars—50-ft. 24-inch gage all steel Koppel mining cars.
Locomotives—6- and 20-ton General Electric trolley with gathering reels.
Drill carriages—Sullivan Machinery Co.
Air compressors—Sullivan Machinery Co.
Drill sharpeners—Sullivan Machinery Co.
Drill steel furnaces—Sullivan Machinery Co.
Fans—American Blower Co.
Drills—Denver Rock Drill Co., Ingersoll-Rand, Chicago Pneumatic.
Diesel engines—Fairbanks-Morse Co.
Motor generator sets—General Electric Co.
Concrete batch boxes and cars—Blaw-Knox and Koppel.
Mixers—Smith.
Conveyors—Northern Conveyor Co.
Main tunnel shovels—Marion Steam Shovel Co.
Main tunnel cars—6-yard Koppel.
Shaft hoists—Ottawa Iron Works.

No. 3 Concrete Unit Nearest Portal at the West Portal. The Batch Box Train Is Shown at the Left, the Hoist at the Upper Right. The Chute at the Lower Right Is Used for Pouring Footings Ahead of the Lining. The Unit Is So Designed That 6-Yard Muck Car Trains Pass Under It

Problems in Concrete Dam Construction

By Arthur S. Bent

President, Bent Brothers, Inc., Los Angeles, Calif.

UT of a long experience in the building of dams, the first thought that arises is that no two of them are exactly alike and no one plan of operation is the optimum for more than a single location. Thus, it is evident that the success of an operation is measured by the correctness of what might be called its diagnosis. Dams on the Pacific Coast are more difficult in estimating and in deciding methods, organization and equipment to be used than is the case with any other structure.

Estimates

In the preliminary estimate, the first thing to consider is the owners with whom one has to deal. Are they responsible and fair-minded? Are their financial plans sound? Are they likely to use up in other developments the funds that should go into the dam before it is completed? What are the character, reputation and experience of the engineers?

The first step in estimating, and by far the most important, is a painstaking, thorough study of the site and all its conditions and this is where the contractor's skill and vision are tested. Independent studies and plans of operation made by different members of his organization, these being later reconciled in the office, will give a plan that represents the consensus of its best judgment. These studies must include accurate knowledge of the topography, water run-off, high-water period, weather history, water supply for the entire year, length of working season and possible methods of river diversion. Thought must be given to the effect on the plant and the work of the inevitable floods and the work so scheduled as to reduce this misfortune to a minimum. Here, the cooperation or otherwise of the engineer is very important. The remoteness and inaccessibility of most dams is an important matter. None of the ordinary facilities for securing skilled labor, supplies, repairs, and spare parts is at hand. The job must be constantly supplied with all these facilities and must be completely self-contained at all times.

Excavation

The estimate must take into careful consideration the character and proportions of soil and rock and their disposal after excavation. This seems too obvious to be worthy of mention, but it is probably on this item that errors of judgment are most common. Certainly there is greater difference in methods and plant for handling the excavating than for the concreting. On one of the writer's jobs, it was believed that bedrock was nowhere more than 14 feet below the stream bed, but in one section it was found at a depth of 52 feet through large boulders and much water. This required a complete and costly readjustment of the entire excavating plant.

As a rule, the estimated cost of excavating and wasting proves inadequate. The excavating constantly suffers all the disadvantages of the work. For instance, it is the reservoir for the poorest of the labor. Untried men are put in the excavating crew. If they prove extra good they are transferred to something else. Again, the shooting of rock cannot be done in the most advantageous way because of the two dangers of injuring the plant and shaking the foundation. Also, other work is usually going on simultaneously and has the precedence, from which it happens that excavating frequently must be done at night, or in very restricted areas, both of which increase the cost.

Cleaning the bed-rock (which should be computed by the square foot) is slow and costly and although computed only once, frequently must be done several times. Here again, the engineer is an uncertain element. It must be done to his satisfaction and this may

The Pacoima Dam Site, Showing the South Abutment at the Left Excavated to Solid Rock and Practically Ready for Concrete. Part of the Plant in the Center Is at the Top of the Incline on Which Cars Are Operated to Bring Up Cement, Sand and Rock to Be Dumped into the Bunkers Below the Tracks. The Top House Is for the Hoist, the Lower House Is for Cement Storage. The Mixers Are Located Below the Cement House

The Pacoima Dam of the Constant Angle Type, Showing the Panel Forms in Position

mean removing loose stuff and hosing off, or it may mean much hand-picking and scrubbing with wire brushes and jetting with compressed air and water. Altogether, the excavation generally costs much more than other excavation jobs that look closely similar, and has proved to be abnormally difficult to estimate with accuracy.

PLANT AND METHOD

On these depend, in the main, the success of the work and the final decision in regard to them is determined by many considerations. The time limit and transportation facilities affect the selection of the plant almost as importantly as the type of dam and the topography. If there is no railroad, and the job is large and the time short, it will pay to build one. Where aggregates can be had near the work it sometimes proves economical to haul and store cement and equipment during the dry season.

On high dams, a hillside plant is desirable. This set-up takes full advantage of gravity and reduces the flood hazard and the danger from falling rocks. However, when roads cannot reasonably be built to the top and there is room for both concrete and excavation plants in the stream bed, a tower is better. In all cases, the concrete delivery point should be well above the dam crest and chutes should be amply large. Low, long dams frequently are best handled by trestle plants with the mixers at one end.

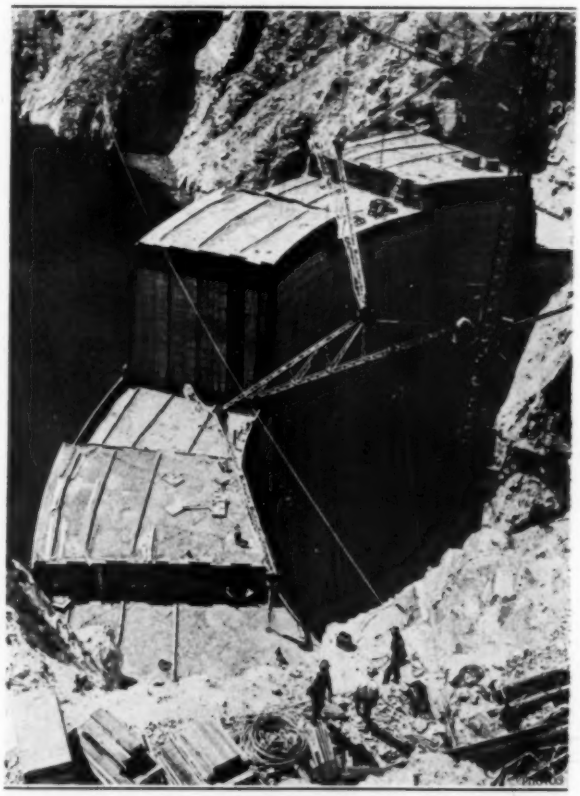
The equipment should be fully adequate, always bearing in mind that the rate of progress cannot be determined by dividing the daily capacity into the total time allowed by the contract. The plant will produce its maximum output only in the middle of the construction. On a fair sized job, it pays well to make a solid and thorough set-up, using plenty of concrete for the foundations of derricks, mixers, compressors, etc. The extra cost is more than compensated by the regularity and certainty of operation. The plant should be of ample capacity. Our practice is to provide for an output fully 50 per cent beyond the needs and on rush jobs to double the estimated demand, yet we have never overdone it. The supply of compressed air, power and light should be ample and reliable. A complete machine shop and saw-mill are essentials. Equipment should be not only adequate, but first class throughout, and the supply of rails, pumps, tanks, pipe, cables, nails, rope, etc., should always be kept well ahead of the needs.

CAMP

Too much emphasis cannot be laid on the importance of this unit because the character of labor attracted to the work and its contentment and efficiency are largely the result of the living environment of the men. Quarters must be adequate, well lighted, heated, ventilated and sanitary. Different quarters should be provided for the different shifts as well as separate meal hours. As many as eighteen different meal hours may be required on rush jobs.

ORGANIZATION

The superintendent must be selected with the utmost care and with particular reference to the work in hand. A rare combination of resourcefulness, speed, economy, executive ability, tact, good judgment, energy and poise is required. He must be able to plan every detail of the operation long in advance without errors.



Top View of Pacoima Dam, Showing Blocks of Concrete Separated by Expansion Joints. This Is the Highest Dam in the World at the Present Time

TRANSPORTATION

A wrong guess on this feature at the outset may paralyze the work later. Provision must be made for handling materials and single pieces of equipment weighing as much as 75 tons rapidly and certainly.

DIVERSION OF WATER

In the diversion of the water, the constructor of dams faces one of his most serious problems. A mistake of judgment may cost him not only great damage to his plant and work, but also the loss of a whole season's work. The problems involved in handling the water are many, for the bottom may be solid rock, or it may be quite pervious and the run-off may vary during the life of the job from a few to tens of thousands of second-feet. Pumping must be expected and its cost is nearly always under-estimated.

DEMOLITION

Unless exceptional vigilance is exercised and the morale of the crew carefully maintained, demolition will show loss and waste. Our system is to sell at once as much of the plant as possible, and on major projects a yard with railroad facilities is rented for the temporary storing and handling of equipment. All equipment, whether to be sold or retained, should be put in first-class order and painted without delay, and all loose parts marked to prevent confusion and loss. The energetic handling of this feature may determine the entire outcome, as it is not uncommon to find on a heavily 'planted' job that its profits must come out of the salvage.

ACKNOWLEDGMENT: Abstract of a paper published in the Proceedings of the American Society of Civil Engineers, Vol. 53, No. 7. Illustrations courtesy of the author.

Lumber Industry Prepares for Greater Year

WITH the closing of the year 1927, and with the business of the organized lumber industry of the country less active than it was during the previous year, extensive plans have been formulated, and are being put into motion, for a greater volume of sales and shipments of lumber in 1928, according to the National Lumber Manufacturers Association, Transportation Building, Washington, D. C. Production was about 8 per cent less in 1926 than in 1927.

The National Lumber Trade Extension Committee at a meeting held in Madison, Wis., November 14 and 15, decided on four important matters. They were: 1. Close alliance of the research work of the Trade Extension Committee with that of the Forest Products Laboratory. 2. Union of the wood box trade extension activities of the National Wood Box Manufacturers' Association and the wood box department of the National Lumber Trade Extension organization. 3. Determination of a tentative budget for 1928 of about $920,000. 4. Decision to adopt a symbol that can be used as distinctive of the lumber manufactured by contributors to the Trade Extension fund. At this same meeting, Trade Extension Manager John M. Gibbs made a plea for universal adoption of American lumber standards as a basic part of trade extension, not only so far as they can be put into practice from the standpoint of grade term rules but including as well the sizes and styles of working on dressed lumber.

The $15,000 slogan contest was started December 1, 1927 and closed January 1, 1928. Two groups of judges, for the preliminary judging, numbering from thirty-five to forty persons, worked out a thorough and equitable system of judging the more than 400,000 entries the final judging being done by carefully selected persons. Approximately 500,000 copies of the "Story of Wood" were distributed by the Committee to individuals, retail dealers, editors and others.

Lumber for airplane hangars is being urged, and a campaign to push the use of wood trusses is soon to be inaugurated. Charles E. Close, Construction Engineer of the Central Division, has conferred with the Underwriters Service Association on insurance rates for hangers with particular reference to rates on wood trusses.

W. F. Shaw, Manager of the Central Division, is cooperating with W. H. Badeaux, Secretary of the Northwestern Lumbermen's Association, in the building program to be undertaken by retail dealers in the Northwest. This latter association, with a potential market of 6,000,000 people in Minnesota, North Dakota, South Dakota, and Iowa, is embarking upon a 3-year program to supply complete building materials service to every farm and city home in the four states. It is planned to have construction experts from universities and farm schools prepare plans and specifications for use in the merchandising program.

Further interest in building codes is being urged by Bert J. Westover, Building Code Engineer of the Central Division, who recently visited a number of cities in the interests of trade extension building code activity.

The work of building a national research and promotion organization is proceeding rapidly, and about thirty engineers, foresters, architects and sales experts have been already engaged.

"Road Courtesy" Not Dead But Dormant

ALTHOUGH the spark of "Road Courtesy" may lately seem to have been entirely extinguished, it begins to look as though all it needed was a little coaxing in the form of a reminder. The notice reproduced below is ample proof that the motoring public as a whole is at heart not only willing, but eager to follow a cooperative suggestion.

This driver will meet all other gentlemen half way on any traffic situation.

The gummed strips are printed in blue with white letters and supplied gratis by the Advertising Department of Mack Trucks, Inc., 252 West 64th Street, New York, which promises to supply them to drivers in any reasonable amount.

A Type of Machine Useful on the Road or on the Lot

Cellar Excavation in Real Estate Development on New Jersey Route 17, Between Hackensack and Arcola, N. J. Keystone Excavator Owned by Edward English, Contractor, Englewood, N. J., and Operated by Fred Bray, 50 Kansas Street, Hackensack, N. J.

Legal Points for Contractors

These brief abstracts of court decisions in the contracting fields may aid you in avoiding legal difficulties. Local ordinances or state laws may alter the conditions in your community. If in doubt consult your own attorney

Edited by A. L. H. Street, Attorney-at-Law

When Unexpected Obstacles in Soil Are Met

Discussion of a Condition of Interest to Excavators

WE are asked to discuss, and cite court decisions bearing upon, the following stated case: The plans under a building contract call for 5-inch slab flooring in the fuel room. When the contractor excavates, he encounters a heavy flow of underground water, unexpected by the owners, their architect, and the contractor.

Question 1. Would the contractor be liable for refusing to proceed until or unless the owners or architect make proper provision for pumping out the water?

Question 2. How far is the contractor chargeable with the expense of removing the water condition?

Question 3. If, after this condition arises, the architect changes the plans, so as to counteract the water, and designates the material to be used; and if the contractor follows these modified plans and specifications, without guaranty of results, what is the contractor's responsibility; and can he recover additional compensation for additional labor and materials furnished to remedy the water condition, there being no express understanding that additional compensation shall be paid?

1. Assuming that there is no special clause in the contract safeguarding the contractor, it seems that the first question must be answered in the negative.

One of the latest—if not the latest—appellate court decisions bearing on this subject was handed down by the Washington Supreme Court in the case of White vs. Mitchell, 213 Pacific Reporter, 10. It was there decided that a contractor could not excuse sagging of a foundation wall on account of defects in the soil and unfavorable weather conditions. The court said, in part:

"There is nothing . . . to show that the soil was of such character as that it was impossible to put down a concrete wall which would not sink, nor is there anything to show that it was impossible to build the house without the presence of great quantities of water constantly standing in the basement. . . . . The mere fact that the ground was soft would not excuse them [the contractors] from the performance of their contract in a proper manner, unless it was of such a character it would be impossible to construct a foundation upon it. . . . . If he [a contractor] wish to protect himself against the hazards of the soil, the weather, labor, or other uncertain contingencies, he must do so by his contract. . . .

"If the water in the basement caused the finished work to be unreasonably damaged and injured, it was their [the contractors'] duty to remedy that condition and remove the water by drainage **or otherwise. . . .**

"It was their duty to examine into the condition of the soil and know the difficulty they might encounter. It was their duty to anticipate that water would be present in the basement to the damage of the house."

The decision in the Washington case is in line with the holding of the highest court of the land in the case of Ingle vs. Jones, 2 Wallace Reports, 1.

In a New Jersey case (Superintendent and Trustee of Public School vs. Bennett, 27 New Jersey Law Reports, 513) it was declared that "no matter what the expense," a contractor who has failed to safeguard himself in the contract "must provide such a substructure as will sustain the building upon that spot until it is complete and delivered to the owner. If he agrees to erect a house upon a spot where it cannot be done without driving piles, he must drive them, because he has agreed to do everything necessary to erect and complete the building. If the difficulties are apparent on the surface, he must overcome them. If they are not, but become apparent by excavation or the sinking of the building, the rule is the same."

The court intimates that the fact that the builder has agreed to erect a building on a certain site is a material factor in determining his responsibility, presumably because he can make soundings if he is unwilling to take chances. Thus viewed, the case is not inconsistent with the holding of the United States Supreme Court (Clark vs. United States, 6 Wallace Reports, 543) that the government should stand loss resulting from settling of an embankment, where the contract did not specify the site but empowered the government to later designate it and the site selected contained defective footing.

But all of the decisions seem to agree that where the unforeseen condition creates impossibility of performance, as distinguished from difficulty, the contractor is excused in abandoning the job. And the Pennsylvania Supreme Court has gone so far as to hold that where, by reason of insufficient solidity of the soil, it is impossible to erect a substantial building supported by the *footings provided in the drawings*, the rule of impossibility of completion for which the contractor is not responsible applies. (Wm. Miller & Sons' Co. vs. Homeopathic Medical & Surgical Hospital & Dispensary of Pittsburgh, 90 Atlantic Reporter, 394.)

In a Rhode Island case (Ford vs. Denning vs. Shephard Company, 90 Atlantic Reporter, 805) the Supreme Court of that state ruled that the mere existence, even to the owner's knowledge, of quicksand on a building site does not relieve the contractor from his obligation. But it was recognized that if the owner omits pertinent matters from the plans and specifications, with intent to deceive the contractor, the contractor, on discovering the deception, would be entitled to quit the job and recover the reasonable value of work done up to that time.

Portable Elevator Manufacturing Co. vs. Dutton, 224 Illinois Appellate Court Reports, 123, was a case involving the construction of cement corn-cribs. It was held that the contractor was not liable for settling of the structures, because of defects in the soil, *after the work had been completed and accepted*. The court said:

"As a general rule the builder is responsible for defects in the building which are caused by defects in the soil, or by weather conditions, notwithstanding the fact that the builder was bound by contract to follow the plans and specifications prepared by the architect. There are, however, exceptions to this rule. It has been held that the builder is not responsible for defects in a building where, by the fault of the owner, the builder is unable to overcome such defects in the soil; or

where the builder has complied with his contract and the defects are subsequently caused by the nature of the soil or the action of the elements."

2. From what has been said it would seem quite clear that if the contractor is not justified in abandoning the job, if it is possible to complete it, although with difficulty, he must bear the expense of shutting off the water.

3. A change in the plans and specifications, if made with the consent of the owner and if involving the furnishing of substantially more labor or materials than originally contemplated, would ordinarily entitle the contractor to additional compensation, but would not affect his responsibility for results. Should subsurface water conditions prevent his delivering a workmanlike job, it is not perceived why his responsibility should be less under modified plans and specifications than under the original ones, assuming that there is no specific provision in either the original contract or the modified one, safeguarding the contractor.

In the case of Creamery Package Manufacturing Co. vs. Russell, 78 Atlantic Reporter, 718, decided by the Vermont Supreme Court, it appeared that in excavating a basement it was discovered that soil conditions would necessitate the construction of a cement foundation for a dry wall, which it had been supposed by both the contractor and the owner would be sufficient if pointed with mortar. The court decided that the contractor was bound to stand the expense of constructing the foundation and that a promise by the owner to pay him therefor was without consideration.

"But," said the court, "the enlargement of the cellar wall and the laying of it in cement, instead of pointing it with mortar, stand different, for the defendant [the contractor] was not bound by the contract to do that, as it specified just how the wall should be built, but, having done it at the direction of the owner, he is entitled to the extra cost of it, and in this respect the judgment is right. It is also right in respect of the brick lining of the underpinning, as that was not called for by the contract as a thing known to be necessary to make the house habitable in this climate or otherwise."

For additional court decisions bearing upon a contractor's rights and liabilities in cases of this kind, see 9 Corpus Juris, 754, 803, 839, and corresponding annotations to that standard legal treatise.

Low Wages Not a Badge of a Workman's Incompetence

In the case of Taylor vs. J. A. Jones Construction Co., 138 South Eastern Reporter, 129, decided by the North Carolina Supreme Court May 18, 1927, it was attempted to charge a subcontractor with liability for a certain personal injury accident, on the theory that he had negligently failed to employ competent workmen. To prove such negligence evidence was offered, tending to show that the subcontractor paid a low scale of wages. Holding that the trial court erred in admitting the evidence, the Supreme Court said:

"The evident purpose of this testimony was to establish the negligence of Markham in failing to employ competent workmen, but we fail to see how the compensation paid a workman or that he was being paid according to the regular scale or any other scale is any evidence of reputation for carelessness in performing his work."

A High Court Passes on a Highway Contract

The case of Road Improvement District No. 5 vs. Roach, 18 Federal Reporter, 2d series, 755, disposed of by the United States Circuit Court of Appeals, Second Circuit, May 4, 1927, involved the right of contractors to disputed compensation for road grading.

The opinion holds that a clause in a construction contract providing for a final certificate by the supervising engineer does not make his decision conclusive, unless mutual intention to so make it appears from the terms of the contract. But it is proper for such a contract to make the decision of the engineer on specified matters of dispute final and conclusive, and, in the absence of fraud or gross mistake, his decision is binding.

It is also held that if the owner changes engineers for the dishonest purpose of securing an unfair advantage in the making of the final estimate, the estimate will not bind the contractor. But the burden is on the contractor to clearly show that the owner has been guilty of bad faith in changing engineers. Mere inexperience on the part of the new engineer will not vitiate his estimate.

And it is decided in the same case that a contract entitling him to pay for all dirt put in a road embankment entitled him to pay for dirt used in filling stump holes under the road. Actual measurements of fills made by a former engineer must control over a mere estimate made by a new engineer who made the final estimate, where by reason of the covering of such fills the new engineer's estimate must be purely theoretical or speculative.

Contractor's Liability to Outsiders

About three weeks after sewer contractors had completed their work, a pedestrian crossing the street was injured through the giving way of the surface over a sewer ditch. Evidently, this was not due to any fault of the contractors, but rather to an underground flow of water. But, in any event, the Oklahoma Supreme Court decided (Armstrong vs. City of Tulsa, 226 Pacific Reporter, 560, May 13, 1924), that the contractors were immune from liability under the following stated rule of law:

"The general rule is that, after the contractor has turned the works over, and it has been accepted by the proprietor, the contractor incurs no further liability to third persons by reason of condition of the work, but the responsibility, if any, for maintaining or using it in its defective condition is shifted to the proprietor. The contractor remains liable, if at all, only to the proprietor for a breach of his contract. . . . The evidence fails to show that the city had formally accepted the work, but it is shown that the sewer ditch had been finished some three or four weeks before the accident, and that the street had been open to the public, for that length of time, and it has been held that all the acceptance that is required by a proprietor of the work of a contractor, in order to relieve the contractor from liability for injury to third persons after the acceptance, is a practical acceptance after the completion of the work; a formal acceptance not being required."

City's Right to Let Contract Was Implied

It is not necessary that a law come right out in plain words and say that a city can have certain work done by contract, instead of doing it by its own employes, before a contract can be awarded, according to the view taken by the Minnesota Supreme Court in the case of Wilke vs. City of Duluth, 215 North Western Reporter, 511, decided October 7, 1927.

A Minnesota law empowers defendant city to acquire and operate a quarry, and "to procure and pay for the necessary equipment of machinery, tracks, and labor required," etc.

Upholding the validity of a contract awarded by the city to a contracting company for removal of the rock at a stated price per cubic yard, the court said:

"It is the claim of the plaintiff that the statute contemplates that the work shall be done directly by the city and not through contractors. It contemplates quite definitely that it may be done directly by the city by means of its own equipment and by hired labor. It does not require it to be done in such way. A usual method of doing such work is by contract and definite prices. Which method should be adopted is a question of policy for the city and not a judicial one for the court."

Prominent Distributors of Construction Equipment

Hustlers Who Help Contractors at Home and Abroad in Many Ways

Boye Portrait
Dan R. Brown, Brown-Bevis Co., Inc., Los Angeles, Calif.

K. B. Noble, Pres., The K. B. Noble Co., Hartford, Conn.

A. C. Blaisdell, Secretary, The Queen City Supply Co., Cincinnati, Ohio

Morton R. Hunter, President, Hunter Machinery Co., Milwaukee, Wisc.

Edward R. Bacon, President, Edward R. Bacon Co., San Francisco, Calif.

Harry C. Collins, President, Collins-Kay Machinery Co., Los Angeles, Calif.

L. M. Wheeler, The Wheeler-Murray Co., Buffalo, N. Y.

W. F. Power, President, The Clarence L. Boyd Co., Inc., Guthrie, Okla.

J. D. Berg, President, Drave Equipment Co., Pittsburgh, Pa.

J. S. Beckwith, President, Beckwith Machinery Co., Pittsburgh, Pa.

F. E. Brown, Vice-President, Beckwith Machinery Co., Pittsburgh, Pa.

E. D. Townsend, Vice-president, Beckwith Machinery Co., Pittsburgh, Pa.

H. W. Fletcher, Treasurer and General Manager, The Clyde Co., New Orleans, La.

T. J. Stone Edelen, Edelen & Boyer Co., Philadelphia, Pa.

Geo. W. Ziegler, President, Geo. W. Ziegler Machinery Co., Pittsburgh, Pa.

P. A. Ransome, Giles & Ransome, Philadelphia, Pa.

C. H. Brinker, President, Brinker Supply Co., Pittsburgh, Pa.

Harry E. Shaw, President, Service Supply Corporation, Philadelphia, Pa.

Herbert Gad, associated with Clifford Waterhouse, Jackson, Miss.

J. L. Latture, President & Manager, J. L. Latture Equipment Co., Portland, Ore.

W. A. Kuhlman, W. A. Kuhlman & Co., Toledo, Ohio

George B. Curd, President, George B. Curd Equipment Co., Cincinnati, Ohio

Frank Moore Studio
Marvin J. Bacon, Manager, Bacon Engineering Sales Co., Cleveland, Ohio

D. R. Petrie, Vice-president, Northwest Equipment Co., Inc., Butte, Mont.

C. G. Milburn, Manager, Milburn Machinery Co., Columbus, Ohio

T. B. Burnite, President, Burnite Machinery Co., Denver, Colo.

Benedict Shubart, Lindroth, Shubart & Co., Denver, Colo.

J. Walker Wilson, Youngstown, Ohio

Fred Mattheis, President, Hedge & Mattheis Co., Boston, Mass.

L. L. Clinton, Clinton & Held Co., Denver, Colo.

Carl G. Borchert, President, Borchert-Ingersoll, Inc., St. Paul, Minn.

Lee Brothers
Wm. H. Ziegler, President, Wm. H. Ziegler Co., Inc., Minneapolis, Minn.

J. W. Dopp, President, J. W. Dopp & Co., Detroit, Mich.

Lowell Bond, The Bond Co., Boston, Mass.

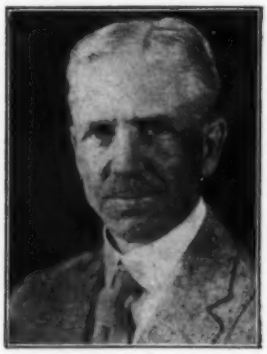
Clyde R. Dodge, C. R. Dodge Co., Boston, Mass.

Charles J. McCarthy, Jr., James J. McCarthy Co., Boston, Mass.

A. L. Felch, Equipment Div., Aberthaw Co., Boston, Mass.

C. A. Wilson, Vice-president and General Manager, Perry & Wilson Equipment Co., Inc., Indianapolis, Ind.

E. W. Johns, Johns Equipment Co., Fort Wayne, Ind.



Wm. H. Hale, Wm. H. Hale & Co., Minneapolis, Minn.

F. P. Wilcox, Clark-Wilcox Co., Boston, Mass.

Frank B. Phinney, 148-152 Fairmount Ave., Hyde Park, Boston, Mass.

R. L. Files, Eastern Tractors Co., Rutland, Vt.

E. A. Martin, President, E. A. Martin Machinery Co., Joplin, Mo.

Geo. F. Smith, President, The Geo. F. Smith Co., St. Louis, Mo.

Elden M. Farnum, Sales Manager, Geo. F. Smith Co., St. Louis, Mo.

Edw. P. Rausch, Vice-President, Geo. F. Smith Co., St. Louis, Mo.

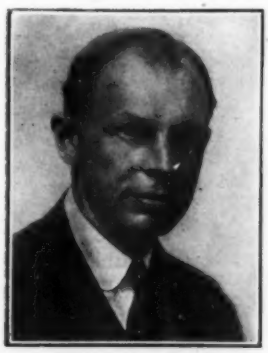
Richard E. Boehck, President, Boehck Machinery Co., Inc., Milwaukee, Wis.

S. T. Hatcher, S. T. Hatcher & Co., St. Louis, Mo.

B. J. Surrett, Manager, Dyar Sales & Machine Co., Cambridge, Mass.

W. A. Hood, Treasurer & Manager, Monarch Equip. Co., St. Louis, Mo.

W. B. May, W. B. May, Inc., Buffalo, N. Y.



Geo. Weber, President, Weber Implement & Automobile Co., St. Louis, Mo.

Leon Rosenbaum, President, J. Jacob Shannon & Co., Philadelphia, Pa.

Harry B. Brewster, President, Brewster & Williams, Inc., Syracuse, N. Y.

Clifford Waterhouse, West Jackson, Miss.

M. B. Ogden, President, Ogden Machy Co., Inc., Tampa, Fla.

J. B. Harbison, Little Rock, Ark., Representative, O. B. Avery Co., St. Louis, Mo.

D. M. Edgerly, Vice-president, Interstate Machinery & Supply Co., Omaha, Nebr.

A. L. Crow, President, Alabama Equipment Co., Birmingham, Ala.

T. A. McDivit, Pres., The Henry H. Meyer Co., Baltimore, Md., and Washington, D. C.

Earle Yancey, Yancey Brothers, Atlanta, Ga.

Geo. L. Earle, Secretary-Treasurer, Good Roads Supply Co. Detroit, Mich.

R. L. Harris, Knoxville, Tenn.

Arthur Prausnitz, President, Engineering Products Co., Peoples Gas Bldg., Chicago, Ill.

James C. Bashford, Bashford-McCord Corporation, Rochester, N. Y.

R. L. Sites, Brown & Sites, Inc., New York City

E. K. Hurst, Vice-President and General Manager, Western Material Co., Sioux Falls, S. D.

Burl V. Hedrick, President, Carolina Tractor & Equipment Co., Salisbury, N. C.

C. H. Neblett, R. B. Everett & Co., Houston, Texas

F. W. Gartner, President, F. W. Gartner Co., Houston, Texas

Charles F. Seabrook, President, C. F. Seabrook Co., Inc., Bridgeton, N. J.

W. H. C. Mussen, President, Mussen Ltd., Montreal, Can.

H. L. McDonald, McDonald & Burgman, Jacksonville, Fla.

L. D. Llewellyn, President, L. D. Llewellyn, Inc., Miami, Fla.

O. H. Miller, General Manager, Choctaw Culvert & Machinery Co., Memphis, Tenn.

R. H. Hyland, President, R. H. Hyland Co., Chicago, Ill.

George E. Hoppe, Richmond, Va.

H. B. Leonard, President, General Utilities Co., Norfolk, Va.

J. W. Bartholow, J. W. Bartholow Co., Dallas, Texas

L. D. Lehman, Manager, Trackson Full-Crawler Co., Portland, Ore.

Ole K. Olsen, 325 N. Cortez St., New Orleans, La.

Albert J. Hahn, President, Service Equipment Co., Philadelphia, Pa.

L. F. Hobbs, Lewter F. Hobbs, Inc., Norfolk, Va.

T. W. Barrett, President and General Manager, Western Contractors Supply Co., Chicago, Ill.

A. J. Thomas, President, Louisiana Road Machinery Co., New Orleans, La.

W. A. Browning, Browning-Ferris Machinery Co., Dallas, Tex.

Thomas L. Barret, Louisville, Ky.

W. M. Bunting, Vice-president, Bunting Hardware & Machinery Co., Kansas City, Mo.

H. Pocock, President, London Concrete Machinery Co., Ltd., London, Ont.

H. O. Penn, President, H. O. Penn Machinery Co., Inc., New York City

J. Shuman Hower, 106 Foster Bldg., Utica, N. Y.

Sales Officials of Leading Manufacturers of Construction Equipment and Supplies

Most of These Officials May Be Seen at the Cleveland Road Show January 9-13

H. S. Greene, Vice-president and Sales Manager, Barber-Greene Co., Aurora, Ill.

Henry N. Schramm, President, Schramm Inc., West Chester, Pa.

Frank Moore Studio

Lion Gardiner, Vice-president and Gen. Sales Mgr., Lakewood Engineering Co., Cleveland, O.

Carl S. Wagner, Sales Manager, Insley Manufacturing Co., Indianapolis, Ind.

K. H. Talbot, Director of Sales, Koehring Co., Milwaukee, Wis.

S. F. Beatty, President, Austin-Western Road Machinery Co., Chicago, Ill.

C. F. Smith, President, Smith Engineering Works, Milwaukee, Wis.

Lee Madden, Vice-President and General Sales Manager, Stover Manufacturing & Engine Co., Freeport, Ill.

C. M. Ballard, Sales Manager, Williamsport Wire Rope Co., Chicago, Ill.

W. M. Neill, Sales Manager, Bates Valve Bag Corp., Chicago, Ill.

J. G. Miller, Vice-president, The Baker Mfg. Co., Springfield, Ill.

H. B. Burlow, Manager, Jobbers' Sales, Templeton, Kenly & Co., Ltd., Chicago, Ill.

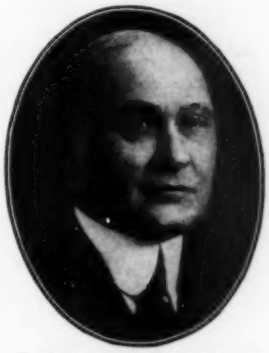
T. M. Deal, Secretary and Sales Manager, Speeder Mchy. Corporation, Cedar Rapids, Iowa

Glen D. Cooper, Assistant Sales Manager, Speeder Mchy. Corporation, Cedar Rapids, Iowa

Chester H. Lehman, General Sales Manager, Blaw-Knox Co., Pittsburgh, Pa.

Paul Johnson, Sales Manager, Construction Machinery Co., Waterloo, Iowa

Alexander P. Jenkins, President and Treasurer, The Alexander Milburn Co., Baltimore, Md.

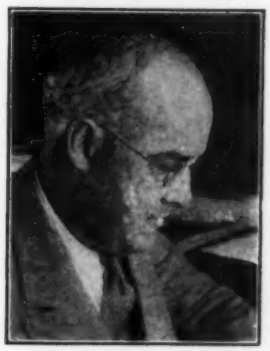


I. B. Jones, Vice-president in charge of Western Sales, Caterpillar Tractor Co., San Leandro, Calif.

John H. Jay, President and Sales Manager, Iowa Mfg. Co., Cedar Rapids, Iowa

A. W. Hodgkiss, Chicago Representative, Warren Brothers Co., Boston, Mass.

Wm. Ford, President, Universal Power Shovel Co., Detroit, Mich.



Frank Temple, Secretary-Treasurer, Universal Power Shovel Co., Detroit, Mich.

W. B. Knickerbocker, President The Knickerbocker Co., Jackson, Mich.

H. H. Dreyer, Manager of Sales, Chicago Automatic Conveyor Co., Chicago, Ill.

J. D. Abram, President, Abram Cement Tool Co., Detroit, Mich.

W. S. Godwin, President, W. S. Godwin Co., Baltimore, Md

R. R. Howard, Sales Manager, Anthony Co., Streator, Ill.

C. F. Reuter, Mead-Morrison Mfg. Co., E. Boston, Mass.

L. J. Kanitz, Manager, Industrial Division, Continental Motors Corporation, Muskegon, Mich.

Clarence E. Bement, Vice-president and General Manager, Nove Engine Co., Lansing, Mich.

E. J. Bement, Treasurer and Sales Director, Nove Engine Co., Lansing Mich.

J. Vale Downie, Sales Manager, Keystone Driller Co., Beaver Falls, Pa.

W. S. Ballsbach, President, New England Road Machinery Co., Boston, Mass.

M. A. Fraher, Treasurer-Manager, Pioneer Tractors, Inc., Winona, Minn.

F. H. Moore, Secretary-Treasurer, Equitable Asphalt Maintenance Co., Kansas City, Mo.

J. T. Frost, Sales Manager, Clyde Iron Works Sales Co., Duluth, Minn.

Geo. P. Kittel, Aeroil Burner Co., Inc., West New York, N. Y.

Geo. W. Fuller, District Sales Manager, Fuller & Sons Mfg. Co., Kalamazoo, Mich.

John H. Earle, Sales Manager, Fuller & Sons, Mfg. Co., Kalamazoo, Mich.

W. E. Swanger, Sales Manager, American Saw Mill Machy. Co., Hackettstown, N. J.

A. C. Picard, General Manager, Lubricator Div., McCord Radiator & Mfg. Co., Detroit, Mich.

Charles H. Foster, Secretary, The Mundy Sales Corporation, New York City

R. O. Perrott, Sales Manager, W. A. Riddell Co., Bucyrus, Ohio

Frank H. Dewey, General Manager, Wood Hydraulic Hoist and Body Co., Detroit, Mich.

S. J. Hunt, Sales Manager, Wiard Plow Co., Batavia, N. Y.

F. L. Averill, Manager, Southern Sales, Wiard Plow Co., Batavia, N. Y.

A. P. Robinson, Sales Manager Ransome Concrete Machinery Co., Dunellen, N. J.

Jack Trevor, Ransome Concrete Machinery Co., Dunellen, N. J.

Howard O. MacMillan, President, M. & M. Wire Clamp Co., Minneapolis, Minn.

M. S. Hotchkiss, Hotchkiss Steel Products Co., Inc., Binghamton, N. Y.

J. Otis Pierce, Sales Manager, Brown-Lipe Gear Co., Syracuse, N. Y.

C. S. Ackley, Sales Manager, McKiernan-Terry Drill Co., New York

L. W. Glaser, Sales Maanger, Littleford Brothers, Cincinnati, Ohio

Lorimer Dunlevy, Sales Manager, Climax Engineering Co., Clinton, Iowa

E. B. Mallory, Vice-president, Climax Engineering Co., Clinton, Iowa

W. E. Orbison, Sales Manager, Roderick Lean Mfg. Co., Mansfield, Ohio

D. D. Guilfoil, Vice-president-General Sales Manager, Sauerman Bros., Inc., Chicago, Ill.

J. F. Richardson, Sales Manager, Buffalo-Springfield Roller Co., Springfield, Ohio

W. L. Schumacher, Vice-president and Treasurer, Toledo Wheelbarrow Co., Toledo, Ohio

Walter C. White, President, The White Co., Cleveland, Ohio.

B. C. Briody, Manager, Highway Products Division, Truscon Steel Co., Youngstown, Ohio

J. N. Heltzel, President and Treasurer, Heltzel Steel Form & Iron Co., Warren, Ohio

W. J. Savage, Vice-president and Sales Manager, Heltzel Steel Form & Iron Co., Warren, Ohio

Theo. Hanau, Sales Mgr., Const. & Mat'l. Handling Equip., S. Flory Mfg. Co., Bangor, Pa.

H. A. Hutchins, Sales Manager, Universal Crane Co., Cleveland, Ohio

S. W. Putnam, Assistant Sales Manager, The Dow Chemical Co., Midland, Mich.

S. Jones Philips, President, Good Roads Machinery Co., Kennett Square, Pa.

S. E. Barlow, President, Huber Manufacturing Co., Marion, Ohio

Hugh L. Rogers, Secretary, Rogers Bros. Corporation, Albion, Pa.

Louis J. Rogers, Vice-president, Rogers Bros. Corporation, Albion, Pa.

Charles A. Rogers, President, Rogers Bros. Corporation, Albion, Pa.

H. F. Kanauer, Sales Mgr., Commercial Div., Highway Trailer Co., Edgerton, Wisc.

Frank F. Hase, President, C. H. & E. Mfg. Co., Milwaukee, Wisc.

H. D. Van Doorn, Assistant Manager, Trackson Co., Milwaukee, Wis.

L. E. Dauer, Sales Manager, Trackson Co., Milwaukee, Wisc.

A. R. Ellis, General Manager, Pittsburgh Testing Laboratory, Pittsburgh, Pa.

A. C. Vicary, Vice-president, Erie Steam Shovel Co., Erie Pa.

J. A. Garber, Assistant General Sales Manager, Erie Steam Shovel Co., Erie, Pa.

D. H. Du Mond, Assistant Sales Manager, Erie Steam Shovel Co., Erie, Pa.

W. S. Miller, Secretary & Sales Manager, Hardsocg Wonder Drill Co., Ottumwa, Iowa

H. W. Redman, Chicago Sales Manager, Koppel Industrial Car & Equipment Co., Koppel, Pa.

Oliver F. Rinderle, President-General Manager, Brown Clutch Co., Sandusky, Ohio

W. W. Cochrane, Secretary and General Manager, G. H. Williams Co., Erie Pa.

T. D. Harter, Assistant General Manager, G. H. Williams Co., Erie, Pa.

Howard A. Winton, General Branch Manager, The Heil Co., Milwaukee, Wis.

F. H. Edson, Sales Manager, The John Lauson Manufacturing Co., New Holstein, Wis.

W. R. Meadows, President, W. R. Meadows, Inc., Elgin, Ill.

J. P. Gilson, President, Kwik-Mix Concrete Mixer Co., Port Washington, Wisc.

Edward M. Ornitz, Sales Manager, Road Building Dept., Blaw-Knox Co., Pittsburgh, Pa.

A. B. Shufeldt, General Manager, Universal Road Machinery Co., Kingston, N. Y.

Harris & Ewing
D. C. Fenner, Manager, Public Works Dept., Mack Trucks, Inc., New York City

W. E. Barbour, Sales Manager, Domestic Engine & Pump Co., Shippensburg, Pa.

INDEX TO DISTRIBUTORS' PHOTOGRAPHS

Aberthaw Co. (A. L. Felch) 32
Alabama Equipment Co. (A. L. Crow) 33
Avery, O. B., Co. (J. B. Harbison) 33
Bacon Engg. Sales Co. (Marvin J. Bacon) .. 31
Bacon, Edward R., Co. (Edward R. Bacon) . 30
Barret, Thomas L. 35
Barrett, T. W. (Western Contractors Supply Co.) 35
Bartholow, J. W., Co. (J. W. Bartholow) .. 35
Bashford-McCord Corp. (James C. Bashford) 34
Beckwith Mchy. Co. (J. S. Beckwith, F. E. Brown, E. D. Townsend) 30
Berg, J. D. (Dravo Equipment Co.) 30
Blaisdell, A. C. (Queen City Supply Co.) .. 30
Boehck Mchy. Co. (Richard Boehck) 33
Bond, The, Co. (Lowell Bond) 32
Borchert-Ingersoll, Inc. (Carl G. Borchert) . 32
Boyd, Clarence L., Co., Inc. (W. F. Power) . 30
Brewster & Williams, Inc. (Harry B. Brewster) 33
Brinker Supply Co. (C. H. Brinker) 31
Brown, F. E. (Beckwith Mchy. Co.) 30
Brown-Bevis Co. (Dan R. Brown) 30
Brown & Sites, Inc. (R. L. Sites) 34
Browning-Ferris Mchy. Co. (W. A. Browning) 35
Bunting Hardware & Mchy. Co. (W. M. Bunting) 35
Burnite Mchy. Co. (T. B. Burnite) 31
Carolina Tractor & Equipment Co. (Burl V. Hedrick) 34
Choctaw Culvert & Mchy. Co. (O. H. Miller) 34
Clark-Wilcox Co. (F. P. Wilcox) 32
Clinton & Held (L. L. Clinton) 32
Clyde, The, Co. (H. W. Fletcher) 31
Collins-Kay Mchy. Co. (Harry C. Collins) .. 30
Crow, A. L. (Alabama Equipment Co.) 33
Curd, Geo. B., Equipment Co. (Geo. B. Curd) 31
Dodge, C. R., Co. (Clyde R. Dodge) 32
Dopp, J. W., Co. (J. W. Dopp) 32
Dravo Equipment Co. (J. D. Berg) 30
Dyar Sales & Machine Co. (B. J. Surrett) .. 33
Earle, Geo. L. (Good Roads Supply Co.) ... 34
Eastern Tractors Co. (R. L. Files) 32
Edelen & Boyer (T. J. Stone Edelen) 31
Edgerly, D. M. (Interstate Mchy. & Supply Co.) 33
Engineering Products Co. (Arthur Prausnitz) 34
Everett, R. B., & Co. (C. H. Neblett) 34
Eldon M. Farnum (Geo. F. Smith Co.) 33
Felch, A. L. (Aberthaw Co.) 32
Files, R. L. (Eastern Tractors Co.) 32
Fletcher, H. W. (The Clyde Co.) 31
Gad, Herbert (Clifford Waterhouse) 31
Gartner, F. W., Co. (F. W. Gartner) 34
General Utilities Co. (H. R. Leonard) 35
Giles & Ransome (P. A. Ransome) 31
Good Roads Supply Co. (Geo. L. Earle) 34
Hahn, Albert J. (Service Equipment Co.) 35
Hale, Wm. H., & Co. (Wm. H. Hale) 32
Harbison, J. B. (O. B. Avery Co.) 33
Harris, R. L. 34
Hatcher, S. T., & Co. (S. T. Hatcher) 33
Hedrick, Burl V. (Carolina Tractor & Equipment Co.) 34
Hedge & Mattheis Co. (Fred Mattheis) 32
Hobbs, Lewter F., Inc. (L. F. Hobbs) 35
Hood, W. A. (Monarch Equipment Co.) 33
Hoppe, George E. 35
Hower, J. Shuman 35
Hunter Mchy. Co. (Morton R. Hunter) 30
Hurst, E. K. (Western Material Co.) 34
Hyland, R. H., Co. (R. H. Hyland) 35
Interstate Mchy. & Supply Co. (D. M. Edgerly) 33
Johns Equipment Co. (E. W. Johns) 32
Kuhlman, W. A., & Co. (W. A. Kuhlman) .. 31
Latture, J. L., Equipment Co. (J. L. Latture) 31
Lehman, L. D. (Trackson Full-Crawler Co.) 35
Leonard, H. R. (General Utilities Co.) 35
Lindrooth, Shubart & Co. (Benedict Shubart) 31
Llewellyn, L. D., Inc. (L. D. Llewellyn) ... 34
London Concrete Mchy. Co. (H. Pocock) ... 35
Louisiana Road Mchy. Co. (A. J. Thomas) .. 35
Martin, E. A., Mchy. Co. (E. A. Martin) ... 32
Mattheis, Fred (Hedge & Mattheis Co.) 32
May, W. B., Inc. (W. B. May) 33
McCarthy, C. J., Jr. (James J. McCarthy Co.) 32
McDivit, J. A. (Henry H. Meyer Co.) 34
McDonald & Burgman (H. L. McDonald) .. 34
Meyer, Henry H., Co. (J. A. McDivit) 34
Milburn Mchy. Co. (C. G. Milburn) 31
Miller, O. H. (Choctaw Culvert & Mchy. Co.) 34
Monarch Equipment Co. (W. A. Hood) 33
Mussens Limited (W. H. C. Mussen) 34
Neblett, C. H. (R. B. Everett & Co.) 34
Noble, K. B., Co. (K. B. Noble) 30
Northwest Equip. Co., Inc. (D. R. Petrie) . 31
Ogden Mchy. Co. (M. B. Ogden) 33
Olsen, Ole K. 35
Penn, H. O., Mchy Co. (H. O. Penn) 35
Perry & Wilson Equip. Co., Inc. (C. A. Wilson) 32
Petrie, D. R. (Northwest Equip. Co., Inc.) . 31
Phinney, Frank B. 32
Pocock, H. (London Concrete Mchy. Co.) .. 35
Power, W. F. (Clarence L. Boyd Co., Inc.) . 30
Prausnitz, Arthur (Engg. Products Co.) 34
Queen City Supply Co. (A. C. Blaisdell) ... 30
Ransome, P. A. (Giles & Ransome) 31
Rausch, Edw. P. (Geo. F. Smith Co.) 33
Rosenbaum, Leon (J. Jacob Shannon & Co.) . 33
Seabrook, C. F., Co., Inc. (C. F. Seabrook) . 34
Service Equipment Co. (Albert J. Hahn) ... 35
Service Supply Corp. (Harry E. Shaw) 31
Shannon, J. Jacob, & Co. (Leon Rosenbaum) 33
Shubart, Benedict (Lindrooth, Shubart & Co.) 31
Sites, R. L. (Brown & Sites, Inc.) 34
Smith, Geo. F., Co. (Geo. F. Smith, Eldon M. Farnum, Edw. P. Rausch) 33
Surrett, B. J. (Dyar Sales & Machine Co.) .. 33
Thomas, A. J. (Louisiana Road Mchy. Co.) 35
Townsend, E. D. (Beckwith Mchy. Co.) 30
Trackson Full-Crawler Co. (L. D. Lehman) .. 35
Waterhouse, Clifford (Herbert Gad) 31, 33
Weber Implement & Automobile Co. (Geo. Weber) 33
Western Contractors Supply Co. (T. W. Barrett) 35
Western Material Co. (E. K. Hurst) 34
Wheeler-Murray, The, Co. (L. M. Wheeler) 30
Wilcox, F. P. (Clark-Wilcox Co.) 32
Wilson, C. A. (Perry & Wilson Equip. Co.) . 32
Wilson, J. Walker 31
Yancey Brothers (Earle Yancey) 34
Ziegler, Geo. W., Mchy. Co. (Geo. W. Ziegler) 31
Ziegler, Wm. H., Co., Inc. (Wm. H. Ziegler) 32

INDEX TO MANUFACTURERS' PHOTOGRAPHS

Abram, J. D. (Abram Cement Tool Co.) 37
Ackley, C. S. (McKiernan-Terry Drill Co.) 39
Aeroil Burner Co., Inc. (Geo. P. Kittel) ... 38
Amer. Saw Mill Mchy. Co., (W. E. Swanger). 33
Anthony Co. (R. R. Howard) 37
Austin-Western Rd. Mchy. Co. (S. F. Beatty). 36
Averill, F. L. (Wiard Plow Co.) 39
Baker Mfg. Co. (J. G. Miller) 36
Ballard, C. M. (Williamsport Wire Rope Co.). 36
Barber-Greene Co. (H. S. Greene) 36
Barbour, W. E. (Domestic Eng. & Pump Co.). 41
Barlow, S. E. (Huber Mfg. Co.) 40
Bates Valve Bag Corp. (W. M. Neill) 36
Beatty, S. F. (Austin-Western Rd. Mchy. Co.). 36
Bement, Clarence E. (Novo Engine Co.) 38
Bement, E. J. (Novo Engine Co.) 38
Blaw-Knox Co. (Chester H. Lehman, Edw. M. Ornitz) 37, 41
Briody, B. C. (Truscon Steel Co.) 40
Brown Clutch Co. (Oliver F. Rinderle) 41
Brown-Lipe Gear Co. (J. Otis Pierce) 39
Buffalo-Springfield Roller Co. (J. F. Richardson) 39
Burlow, H. B. (Templeton, Kenley & Co.) .. 36
C. H. & E. Mfg. Co. (Frank F. Hase) 40
Caterpillar Tractor Co. (I. E. Jones) 37
Chicago Automatic Conveyor Co. (H. H. Dreyer) 37
Climax Engineering Co. (Lorimer Dunlevy, E. B. Mallory) 39
Clyde Iron Works Sales Co. (J. T. Frost) .. 38
Cochrane, W. W. (G. H. Williams Co.) 41
Construction Mchy. Co. (Paul Johnson) 37
Continental Motors Corp (L. J. Kanitz) 38
Cooper, Glen D. (Speeder Mchy. Corp) 37
Dauer, L. E. (Trackson Co.) 40
Deal, T. M. (Speeder Mchy. Corp.) 37
Dewey, Frank H. (Wood Hydraulic Hoist & Body Co.) 38
Domestic Engine & Pump Co. (W. E. Barbour) 41
Dow Chemical Co. (S. W. Putnam) 40
Downie, J. Vale (Keystone Driller Co.) 38
Dreyer, H. H. (Chicago Automatic Conveyor Co.) 37
Du Mond, D. H. (Erie Steam Shovel Co.). 41
Dunlevy, Lorimer (Climax Engineering Co.) 39
Earle, John H. (Fuller & Sons Mfg. Co.).. 38
Edson, F. H. (John Lauson Mfg. Co.) 41
Equitable Asphalt Maintenance Co. (F. H. Moore) 38
Ellis, A. R. (Pittsburgh Testing Laboratory) 40
Erie Steam Shovel Co. (D. H. Du Mond, J. A. Garber, A. C. Vicary) 41
Fenner, D. C. (Mack Trucks, Inc.) 41
Flory, S., Mfg. Co. (Theo. Hanau) 40
Ford, Wm. (Universal Power Shovel Co.).. 37
Foster, Chas. H. (The Mundy Sales Corp.) 38
Fraher, M. A. (Pioneer Tractors, Inc.) 38
Frost, J. T. (Clyde Iron Works Sales Co.).. 38
Fuller & Sons Mfg. Co. (John H. Earle, Geo. W. Fuller) 38
Garber, J. A. (Erie Steam Shovel Co.) 41
Gardiner, Lion (Lakewood Engineering Co.) 36
Gilson, J. P. (Kwik Mix Concrete Mixer Co.) 41
Glaser, L. W. (Littleford Brothers) 39
Godwin, W. S. (W. S. Godwin Co.) 37
Good Roads Mchy. Co. (S. Jones Phillips).. 40
Greene, H. S. (Barber-Greene Co.) 36
Guilfoil, D. D. (Sauerman Brothers, Inc.).. 39
Hanau, Theo. (S. Flory Mfg. Co.) 40
Hardsocg Wonder Drill Co. (W. S. Miller). 41
Harter, T. D. (G. H. Williams Co.) 41
Hase, Frank F. (C. H. & E. Mfg. Co.) 40
Heil Co., The (Howard A. Winton) 41
Heltzel Steel Form & Iron Co. (J. N. Heltzel, W. J. Savage) 40
Highway Trailer Co. (H. K. Kanauer) 40
Hodgkiss, A. W. (Warren Brothers Co.) 37
Hotchkiss, M. S. (Hotchkiss Steel Products Co., Inc.) 39
Howard, R. R. (Anthony Co.) 37
Huber Mfg. Co. (S. E. Barlow) 40
Hunt, S. J. (Wiard Plow Co.) 39
Hutchins, H. A. (Universal Crane Co.) 40
Insley Mfg. Co. (Carl S. Wagner) 36
Iowa Mfg. Co. (John H. Jay) 37
Jay, John H. (Iowa Mfg. Co.) 37
Jenkins, Alexander F. (The Alexander Milburn Co.) 37
Johnson, Paul (Construction Mchy. Co.) 37
Jones, I. E. (Caterpillar Tractor Co.) 37
Kanauer, H. F. (Highway Trailer Co.) 40
Kanitz, L. J. (Continental Motors Corp.)... 38
Keystone Driller Co. (J. Vale Downie) 38
Kittel, Geo. P. (Aeroil Burner Co.) 38
Knickerbocker, W. B. (Knickerbocker Co.).. 37
Koehring Co. (K. H. Talbot) 36
Koppel Industrial Car & Equip. Co. (H. W. Redman) 41
Kwik Mix Concrete Mixer Co. (J. P. Gilson) 41
Lakewood Engineering Co. (Lion Gardiner) 36
Lauson, The John, Mfg. Co. (F. H. Edson). 41
Lean Mfg. Co., Roderick (W. E. Orbison). 39
Lehman, Chester H. (Blaw-Knox Co.) 37
Littleford Brothers (L. W. Glaser) 39
Mack Trucks, Inc. (D. C. Fenner) 41
MacMillan, H. O. (M. & M. Wire Clamp Co.). 39
Madden, Lee (Stover Mfg. & Engine Co.).. 36
Mallory, E. B. (Climax Engineering Co.).. 39
McCord Radiator & Mfg. Co. (A. C. Picard) 38
McKiernan-Terry Drill Co. (C. S. Ackley). 39
Mead-Morrison Mfg. Co. (C. F. Reuter).. 37
Meadows, W. R. (W. R. Meadows, Inc.).. 41
Milburn, The Alexander, Co. (Alexander F. Jenkins) 37
Miller, J. G. (Baker Mfg. Co.) 36
Miller, W. S. (Hardsocg Wonder Drill Co.) 41
M. & M. Wire Clamp Co. (Howard O. MacMillan) 39
Moore, F. H. (Equitable Asphalt Maintenance Co.) 38
Mundy, The, Sales Corp. (Chas. H. Foster). 38
Neill, W. M. (Bates Valve Bag Corp.) 36
New England Road Mchy. Co. (W. S. Railsbach) 38
Novo Engine Co. (Clarence E. Bement, E. J. Bement) 38
Orbison, W. E. (Roderick Lean Mfg. Co.). 39
Ornitz, Edw. M. (Blaw-Knox Co.) 41
Perrott, R. O. (W. A. Riddell Co.) 38
Phillips, S. Jones (Good Roads Mchy. Co.). 40
Picard, A. C. (McCord Radiator & Mfg. Co.) 38
Pierce, J. Otis (Brown-Lipe Gear Co.) 39
Pioneer Tractors, Inc. (M. A. Fraher) 38
Pittsburgh Testing Laboratory (A. R. Ellis) 40
Putnam, S. W. (The Dow Chemical Co.) 40
Railsbach, W. S. (New England Road Mchy. Co.) 38
Ransome Concrete Mchy. Co. (A. P. Robinson, Jack Trevor) 39
Redman, H. W. (Koppel Industrial Car & Equip. Co.) 41
Reuter, C. F. (Mead-Morrison Mfg. Co.) 37
Richardson, J. F. (Buffalo-Springfield Roller Co.) 39
Riddell, W. A., Co. (R. O. Perrott) 38
Rinderle, Oliver F. (Brown Clutch Co.) ... 41
Robinson, A. P. (Ransome Concrete Mchy. Co.) 39
Rogers Bros. Corp. (Chas. A. Rogers, Hugh L. Rogers, Louis J. Rogers) 40
Sauerman Brothers, Inc. (D. D. Guilfoil).. 39
Savage, W. J. (Heltzel Steel Form & Iron Co.) 40
Schramm, Henry N. (Schramm, Inc.) 36
Schumacher, W. L. (Toledo Wheelbarrow Co.) 39
Shufeldt, A. B. (Universal Road Mchy. Co.) 41
Smith, C. F. (Smith Engineering Works).. 36
Speeder Mchy. Corp. (Glen D. Cooper, T. M. Deal) 37
Stover Mfg. & Engine Co. (Lee Madden).. 36
Swanger, W. E. (American Saw Mill Mchy. Co.) 38
Talbot, K. H. (Koehring Co.) 36
Templeton, Kenly & Co. (H. B. Burlow) 36
Temple, Frank (Universal Power Shovel Co.) 37
Toledo Wheelbarrow Co. (W. L. Schumacher) 39
Trackson Co. (L. E. Dauer, H. D. Van Doorn 40
Trevor, Jack (Ransome Concrete Mchy. Co.) 39
Truscon Steel Co. (B. C. Briody) 40
Universal Crane Co. (H. A. Hutchins) 40
Universal Power Shovel Co. (Wm. Ford, Frank Temple) 37
Universal Road Mchy. Co. (A. B. Shufeldt) 41
Van Doorn, H. D. (Trackson Co.) 40
Vicary, A. C. (Erie Steam Shovel Co.) 41
Wagner, Carl S. (Insley Mfg. Co.) 36
Warren Brothers Co. (A. W. Hodgkiss) 37
White, The Co. (Walter C. White) 39
Wiard Plow Co. (F. L. Averill, S. J. Hunt) 39
Williams, G. H., Co. (W. W. Cochrane, T. D. Harter) 41
Williamsport Wire Rope Co. (C. M. Ballard) 36
Winton, Howard A. (The Heil Co.) 41
Wood Hydraulic Hoist & Body Co. (Frank H. Dewey) 38

How to Splice Wire Cables

SPLICING of wire cables is an operation that every operator of excavating and other construction equipment should be able to do well. It may be learned and performed by any mechanic, but considerable practice and care are necessary to make a complete and perfect job. Only a few light hand tools are needed in the method described here.

For 1-inch cable and smaller, the proper tools are as follows:

One pair of 14-inch "Carew" wire cutters, heavy nipper type, or a cold chisel and hammer.
One 12-inch round, tapered Marline spike made of tempered steel about 1 inch thick at the heaviest end with a thin, flat point.
One short, round spike about 7 inches long of tempered steel with ground handle. (This may be made from a ⅜-inch round file, annealed and ground smooth with point flattened and then retempered.)
One sharp pointed knife with short blade.
A small bar, or lever, of wood.
One piece of ½-inch hemp rope for making a sling about 6 feet long.
One medium size portable vise.
In addition, a small amount of "hay wire" (about 14-inch gage soft wire) and some electricians' tape will be needed.

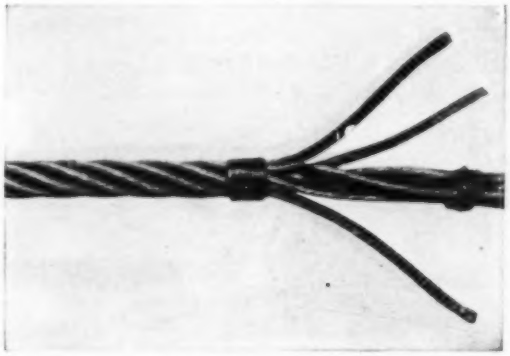


Fig. 1—First Step in Preparing End of Cable

The tools for dealing with cables larger than 1-inch are similar to those listed above, but heavier. The following table is a guide to the proper amount of extra cable to allow for use in making what is known as the long or endless splice in standard 6 x 19 wire cables:

Dia. of Cable in Inches	Footage to Allow for Splicing
⅜ inch	16 feet
½ "	16 "
⅝ "	20 "
¾ "	24 "
⅞ "	28 "
1 "	32 "
1⅛ "	36 "
1¼ "	40 "
1½ "	44 "

The job to be described here is a splicing of a ¾-inch diameted 6 x 19 cable, requiring 24 feet of extra cable for the splice. The work of splicing will be expedited and a better job can be made if attention is given to carefully preparing the two ends of the cables. Also, some planning ahead is quite necessary, as there will be many rehandlings of the work before starting the finishing operations of the splice.

PREPARING ENDS OF CABLES

The ends of two cables to be spliced are prepared alike. First, place a wire tie securely 12 feet from the end of the cable. This tie is to prevent the strands from unwinding beyond the footage allowed for making the splice. Before removing the end seizing of wire, place a temporary tie of wire or stout twine about one foot from the cable end. Next remove the end seizing. Select every other one of the six strands in the cable, bend these three alternate strands out from the rope and then with a piece of wire, refasten the other three strands against the hemp center. The end of the cable will now appear like Fig. 1.

The next operation will be to cut away the temporary tie and unwind the three loose alternate strands back to the secure tie until 12 feet of three strands have been parted. The three remaining alternate strands and the hemp center which were left tied together may now be cut away about one foot from the tie or 11 feet from the end. Also, untwist the hemp centers, but do not cut off the surplus of the hemp until later. Both ends of the cable will now be as illustrated in Fig. 2.

Now place one end of the cable in a vise close to the wire tie holding the strands together. Next place the two ends together, interlocking the long strands in alternate positions, taking care that no two of the long strands are together either to the left or to the right (see Fig. 3).

A helper will be required now to hold the ends of the cable together tightly and also to hold the left piece of cable to prevent the strands from further unwinding. The helper will now be standing back of the work and the splicer in front with the cable between them. As the helper holds the two pieces of cable together, the splicer removes the wire tie on the piece of cable to his left leaving the tie on the right. As one of the short strands to the left is then untwisted from the rope, a long strand from the right that has been in the opposite position is laid in the seam of the groove just made in the cable by the removal of the short piece.

FIRST LAY IS IMPORTANT

The starting positions of these strands is shown in Fig. 4. This step is important in the making of a good splice. If the lay or spiral twist of this first long strand being laid in does not conform to the curve of the groove left by the short end, stop the work of laying in the strand. With the helper holding the ends, further unravel one of the hemp centers while twisting together the opposite hemp end. This adjustment of ends need be but a matter of an inch or less to bring the spiral direction of the strand into proper line with that of the groove.

With the first lay properly adjusted and laid in at the start, all of the other strands that follow in the splicing will easily set into their correct position in the cable. As the strand is passed around the cable, watch carefully that the strand does not untwist from the spiral shape in which it was "set" in the manufacture of the rope. Proceed slowly, pressing and twisting the long strand into position in the groove while continuing to remove the short strand. Do not unwind the short strand ahead of the laying in of the long strand but rather handle

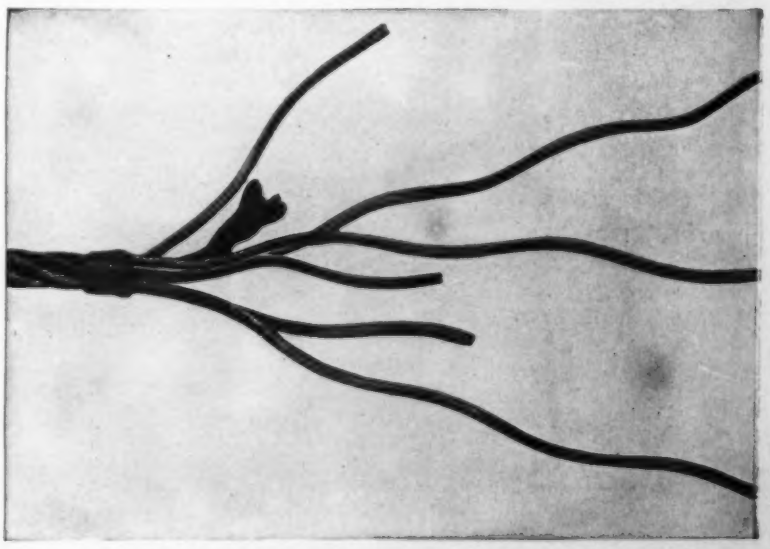


Fig. 2—End of Cable All Made Ready for Splicing Operation

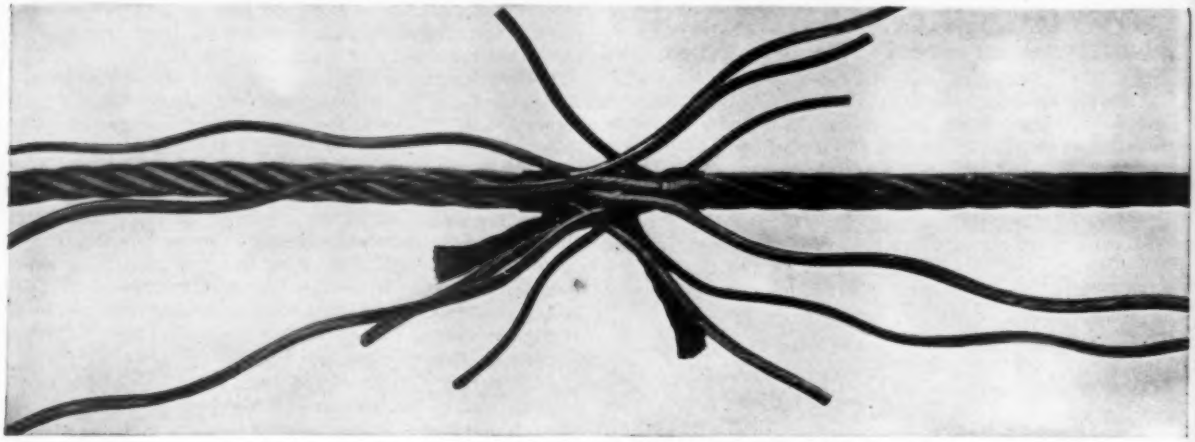


Fig. 3—The Ends of the Two Cables Brought Together to Start the Splice

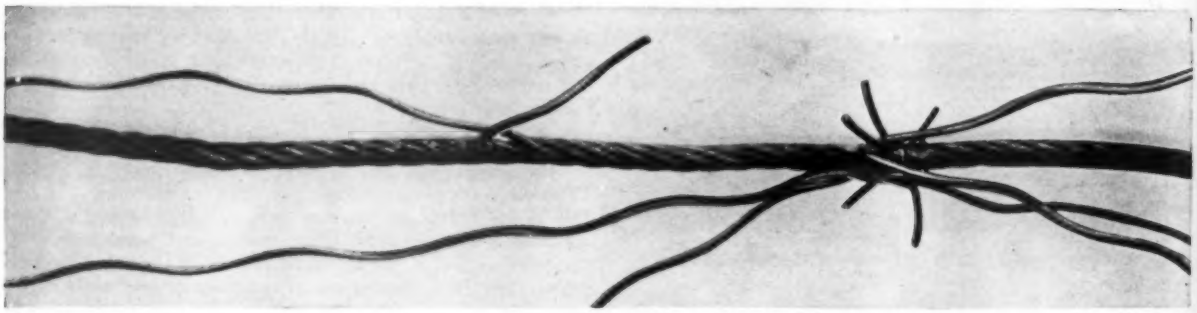


Fig. 4—Making the First Lay, a Highly Important Step in the Process

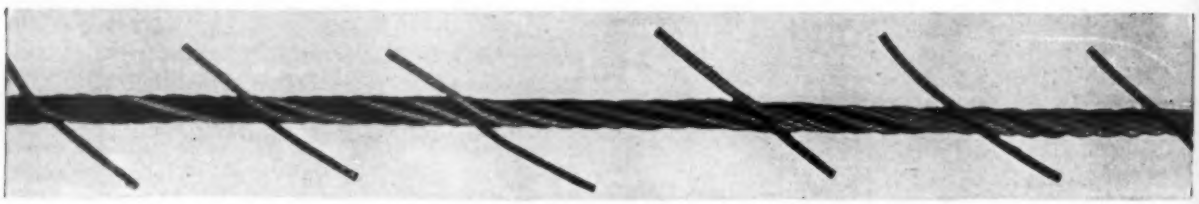


Fig. 5—Black Cable (at Left) and White Cable (Right) Partially Spliced, Showing 12 Strand Ends

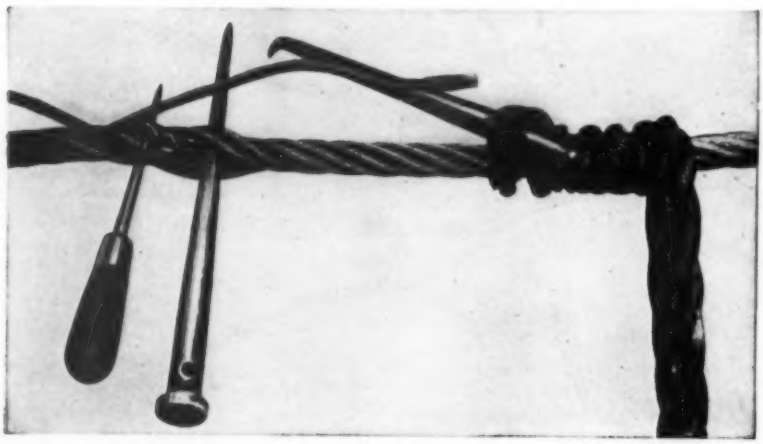


Fig. 6—Opening the Cable and Picking Out the Hemp Center

both operations together. If the strand does not set down into the cable even with other strands tap lightly with the heavy end of the Marline spike before proceeding further. This first strand is laid its full length, leaving a 1-foot end. Cut away the strand just removed, leaving also a 1-foot end. Make a temporary tie with a wire (or a ravel from the hemp center will do), tying these two ends of strand against the cable to prevent any unwinding during the further handling of the rope while the other strands are laid into position.

The second long strand from the right may now be placed in the left cable while removing another short strand. This operation is the same as that just described. The work of laying in this strand is stopped while the end is about 40 inches long. Both of the ends in this set are now cut, leaving

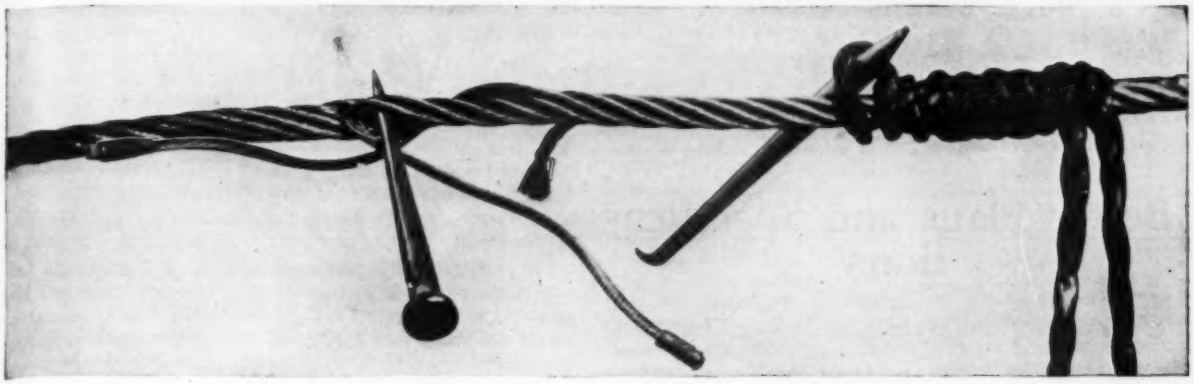


Fig. 7—Tucking One of the Strand Ends into Center of the Cable

two more 1-foot ends tied against the cable as before. These should be spaced 30 inches or more to the right of the first pair. The last short strand to the left is now unwound as the other long strand is placed into the last groove. This last strand is not laid very far. Cut these two strand ends as before. There now should be three pairs of strand ends on the surface of the left piece of cable all temporarily tied down.

As this example is to show the splicing of a ¾-inch diameter, 6 x 19 wire cable, the ends should all be one foot long and spaced about 30 inches apart. For other sizes of cable, the spacings and lengths of ends will be in proportion to the extra cable used in splicing as shown in the table at the beginning of this article.

The wire tie holding the right piece of cable together is now removed. Before starting the work of laying any strands to the right see that the ends of the two hemp centers are cut away and tucked in snugly so that no hollow gap or bunch is left in the cable at this point. The work of laying in the strands and the spacing of ends to the right will be a repetition of that just described while working to the left. After all of the remaining strands are laid in they should also be spaced and temporarily tied as before. All ends should be so spaced that about 6 inches of hemp center will be left in the cable between the ends of the strands after they have been tucked into the center. There should be a wider space between the ends sticking out of the cable at the center where the two pieces were first joined as no tucks should be made close to this point. If a piece of black cable and a piece of white cable had been used the work at this stage would appear as in Fig. 5, with 12 ends of strands projecting at six different positions.

TUCKING IN THE ENDS

The next and finishing operation is that of tucking these 12 ends into the center. Before starting this work it would be well to wrap all the ends of strand with electricians' tape to make their diameter the same as the hemp center that is to be removed. The tape will also act as a cushion and prevent internal wear against the outside strands. If tape is not used, wrap the ends of the strands tightly with fine wire or raveling from the discarded hemp center, thus preventing any of the 19 small wires from sticking out between the strands of the finished splice.

Further, before starting the tucks, another simple but important treatment of these strand ends should be made. After removing the temporary tie that has held the end in place, bend the end of each strand back into a sharp kink close to the cable at the point where the strand ends have been crossed. Also, untwist the strand at this same point until the strand is quite flat and the wires separated at the point of the kink. Partly straighten the kink back so that the strand ends may be tucked into the center in the same direction as they were laid into the cable. This kink and twist is to allow the strand ends to taper away from each other at the point of the tuck so that no bunch will show in the finished work. When properly done this forms a tapered joint, that also prevents the tuck from creeping.

The cable is again placed in a vise as shown in Fig. 6. The end of the strand to be tucked in is so placed into the vise that it cannot be unwound past the tapered joint referred to in the preceding paragraph.

The hemp sling and lever is now fastened on the cable also as shown in Fig. 6. Twisting the lever held in the sling will cause the cable to open. If a vise is not handy a second lever and sling may be used to hold the cable.

After the cable has been opened insert the short spike under two or three strands. Follow right alongside with the large spike. Rotating this large spike will now further open the cable. The small spike is then used to pick out the hemp center so that it may be cut. This operation is best shown in Fig. 6.

After cutting the center and pulling out the ends, place the small spike between the strands and rotate the large spike while further removing the center. As the hemp cord is pulled out, work the prepared strand end into the center of the cable with one of the spikes. Next trim the end of hemp snug against the end of the tucked-in strand. The positions of the spikes and lever and the starting position of the strand end being worked in are all shown in Fig. 7. Do not remove any more of the hemp than necessary, as it is important that no hollow spaces be left in the center of the finished work.

The smaller spike is now used to hold the strand and hemp into the center of the cable while the lever is released and the cable closed. Reverse the grip of the vise and lever and also the handling of the spikes, tuck in the other strand end at this same point and again trim the center. The last operation is to bend the cable with the hands in different directions to ad-

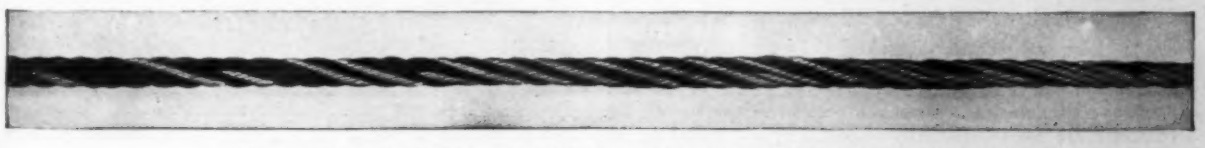


Fig. 8—The Finished Splice: Black Cable at Left Joined to White Cable at Right

just the center and outside strands into the original positions. The operation is the same for tucking in all of the 12 ends referred to, of course, moving the vise, lever and sling over to each pair of ends.

Don't splice worn cables!

ACKNOWLEDGMENT: Reprinted from an article by B. T. Macy, in *Sauerman News*.

Better Plans and Specifications

INCREASING criticism, by general contractors and sub-contractors for building work, of the character of specifications and drawings prepared by some architects and engineers, upon which definite competitive and binding proposals are expected, has convinced the Boston Society of Architects that these criticisms should receive serious consideration and that steps should be taken, when criticisms seem to be well founded, to bring about a better and fairer order in these important features.

Fifty-five quotations from current specifications and plans were brought to the attention of the Society several months ago, and a committee was appointed to study them and report with recommendations. The criticisms mainly related to vagueness or insufficiency of information. The Committee made careful study and in its formal report stated that all the criticisms were justified and that the Society should take positive action to correct any such improper conditions.

The Society adopted the recommendations of its Committee and decided that to deal with the situation properly, a permanent Board should be set up by the Society (with cooperation of other organizations concerned in such matters), such Board to be authorized to consider criticisms, use its influence to adjust cases, and gradually develop minimum standards to be observed in the preparation of plans and specifications, said standards to be acknowledged and used by architects and engineers as good practice.

The Society, therefore, acting with the cooperation of the Boston Building Congress and the Boston Society of Civil Engineers, has set up a Board of Reference composed of persons appointed by the three organizations, in the hope that through the opportunity thus offered for consideration of criticisms, and by the Board's activities and influence, the makers of plans and specifications will have a clearer understanding of the importance of presenting their problems with fairness, precision, and definiteness, so that contractors may clearly understand the problems and may make proper and definite estimates.

The bodies uniting in the creation of this Board believe that the cases already considered furnish ample basis for beginning the formulation of minimum standards and with further cases which will be considered by the Board, a code can be framed which will be to the great advantage of all concerned.

The Board is composed of twelve members: five selected by the Boston Society of Architects, five by the Boston Building Congress, and two by the Boston Society of Civil Engineers. These appointments have been made, the Board is duly organized, and is prepared to carry out the purpose for which it is established.

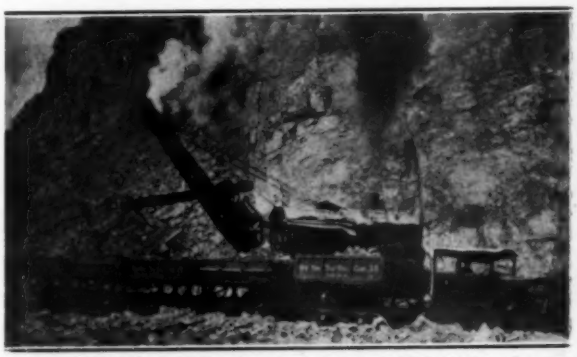
The procedure of the Board will be somewhat as follows:

Whenever a general contractor or sub-contractor, competitively bidding on plans and specifications, discovers therein any requirements which, in his opinion, are unfair as to general conditions and guarantees or inadequate in their explanation, he is invited to submit the matter promptly to the Board, through its clerk, before the competitive proposals are handed in. The source of such information will be confidentially treated by the Board. If the Board thinks the bidder's criticisms justified, it will call it to the attention of the maker of the said plans and specifications. If, in the opinion of the Board, the criticisms are not satisfactorily answered by the maker of the plans and specifications, he will be asked to amend them or issue additional explanatory information to cover the omissions or defects. Should he decline to issue such amendments on the plea of lack of time, but with the assurance that thereafter such inadequacies will not occur in his work, the Board will consider the case closed. If, on the other hand, the maker of the said plans and specifications should refuse to acknowledge the justice of the criticisms and to correct them in future work, the Board would then make a formal report on the case, filing copies of the report with the proper officers of the Boston Society of Architects, the Boston Building Congress, and the Boston Society of Civil Engineers.

The cases considered will supply a basis for items in the future minimum-standards. At intervals all such items will be tabulated in the form of a Code of Practice which the above-named organizations will be asked to approve. Such approval will constitute a declaration of proper practice in the preparation of plans and specifications for competitive estimating purposes. It is expected that the Code, with illustrative cases, will be printed from time to time and widely distributed to all the local factors in the Building Industry.

It is not the function of the Board to intervene between architects or owners and contractors after contracts are once made, but if the preliminary work of estimating can be put upon a proper basis, in accordance with such a Code, it is believed that the probability of later disputes will be largely diminished. The Board, therefore, will not function as arbitrators. In the opinion of the Board, provisions for "arbitration" should be embodied in some form in all contracts for building work; the Standard Documents of the American Institute of Architects make specific provision for such service.

From Quarry to Concrete in Rockland County, N. Y.



Loading and Haulage Equipment at Cedar Cliff, N. Y., Quarry of the New York Trap Rock Co. Bucyrus Steam Shovel, Western Dump Cars and Whitcomb Gasoline Locomotive

Orr & Sembower Mixer on Small Concrete Bridge Job at Orangeburg, N. Y.

Who's Who in Construction

A Series of Reports from Active Contractors Published Monthly

BUS. VOL.—ANNUAL VOLUME OF CONTRACTS

A—Over $5,000,000
B—Between $1,000,000 and $5,000,000
C—Between $500,000 and $1,000,000
D—Between $250,000 and $500,000
E—Under $250,000

W. J. Runyon Paving Co., Sheffield, Ala., First Street. Organized October 13, 1925. Bus. vol. C. Organized as the Muscle Shoals Construction Co., Inc., in 1923. In 1925, W. J. Runyon purchased the shares of the other two stockholders and the company became the W. J. Runyon Paving Co., with W. J. Runyon sole owner. Officers: W. J. Runyon, President. Major contracts: 1925, City of Tuscumbia and Shirley Manor, Tuscumbia, Ala.; 1926, Alabama State Highway Project 158, and Huntsville, Ala., also project for John J. Nyhoff; 1927, project Sheffield, Ala., and project for Muscle Shoals Land Corp. Member: A. G. C. of A.

Walter H. Denison, Cushman, Ark. Branch office: Amarillo, Tex. Organized 1901. Bus. vol. B. Commenced contracting in July, 1901, on the White River Extension of the Denison & Shafer, from 1907 to 1927 operated as Walter H. Denison, and from 1918 to 1927, had a half interest in the firm of Denison & Brown. Officers: Walter H. Denison, General Manager and Walter Denison, Jr., Superintendent. Member: A. G. C. of A.

D. C. Horton

D. C. Horton, Inc., Little Rock, Ark., 2111 West 4th Street, Branch office: 823 No. Second Street, Fort Smith, Ark. Organized August, 1927. Bus. vol. C. This is a corporation, succeeding D. C. Horton as an individual. Officers: D. C. Horton, President; M. B. Horton, Vice-president; E. F. Horton, Secretary. Major contracts: 1925, Webster County, Mo., state highway; 1926, Henry County and St. Clair County, Mo., state highway; 1927, District 429-30, Little Rock, paving and drainage. Member: Missouri Branch and Arkansas Branch, A. G. C. of A.

Bent Brothers, Inc., Los Angeles, Calif., 418 South Pecan Street. Organized 1923. Bus. vol. B. Began in 1886 as Arthur S. Bent, contractor for irrigation systems, chiefly concrete pipe. In 1908, H. Stanley Bent, his brother, came in as partner. In 1923, business incorporated under present title, stock being all held in family. Company has specialized in concrete dams, power houses, reservoirs, highways and general public works. Officers: Arthur S. Bent, President; H. Stanley Bent, Vice-President and General Manager; W. Atkinson, Treasurer. Major contracts: Talent Dam, Oregon; Exchequer Dam, Calif.; thirty-four oil storage reservoirs of 43 million barrels; Pacoima Dam in California, highest in the world; Bull Run Dam, Oregon; Heinshaw Dam, California. Member: U. S. Chamber of Commerce, Los Angeles Chamber of Commerce, California Development Association, A. G. C. of A., Merchants and Manufacturers Association, Los Angeles, and Los Angeles Realty Board.

Arthur S. Bent

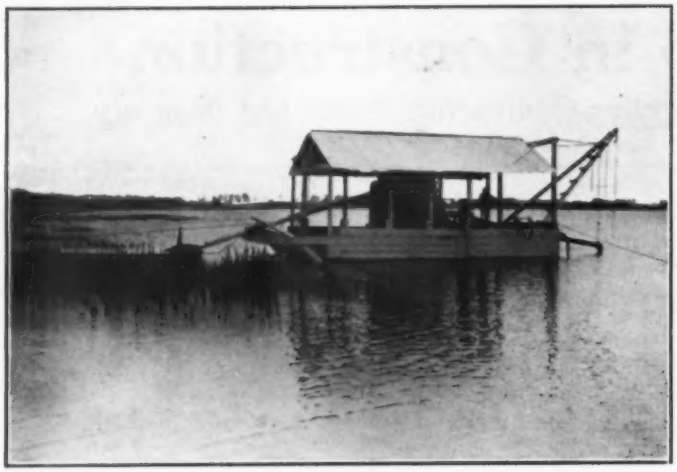
Lord and Bishop, Napa, Calif., 333 Randolph Street. Branch office: Storrie, Plumas County, Calif. Organized 1920. Bus. vol. D. Officers: H. S. Lord and A. F. Bishop, a co-partnership. Major contracts: Constant angle arch dam, Oroville, Calif., for Oroville Wyandotte Irrigation District, 12,000 yards of concrete, 1,200 feet tunnel concreted; three underpasses for Sacramento, Calif.; two constant angle arch dams, Feather River Power Project, 18,000 yards of concrete, Bucks Diversion, 15,000 yards of concrete Grizzly Diversion. Member: A. G. C. of A.

H. Stanley Bent

Kaiser Paving Co., Oakland, Calif., 1522 Latham Square Building. Branch offices, Camaguey, Cuba, Livermore, Calif., and Deetz, Calif. Organized June 16, 1916. Operated in British Columbia prior to 1916 as Henry J. Kaiser, Ltd., and as the Nanaimo Paving Co. Officers: Henry J. Kaiser, President; S. McWhorter, Treasurer; G. G. Sherwood, Secretary. Major contracts: 1924, paving Sacramento-Stockton Highway, 16 miles, for California Highway Commission; paving Pacific Highway north from Redding, 14 miles, for California Highway Commission; paving streets in Mayfield, Calif; 1925, paving for Berkeley, Calif., paving Arroya Highway, 6 miles, for county of Alameda, Calif; paving yards and constructing concrete foundations for oil tanks for the General Petroleum Corporation; paving Pacific Highway north of Oakland, 8 miles, for California Highway Commission; constructing Gordon Valley Dam for City of Vallejo, Calif.; widening Pacific Highway, Yolo County, Calif., for California Highway Commission; 1926, paving highway from Livermore to Veterans Hospital, 6 miles, for Alameda County, Calif.; paving streets of Livermore, Calif.; paving streets of Mt. Shasta, Calif.; constructing Philbrook Dam for Pacific and Electric Co.; 1927, widening Peninsula Highway south of San Francisco, for California Highway Commission; widening and reconstructing Redwood Highway south of Eureka, for California Highway Commission; and paving streets in Mt. Shasta, Calif. During this time also the company operated a commercial sand and gravel producing plant at Livermore, Calif., and a rock crushing plant at Deetz, Calif., for commercial trade. Member: A. G. C. of A., and Highway Development Association of California.

Valley Paving & Construction Co., Visalia, Calif., Bank of Italy Building. Branch offices: Merced, Hilmar, McFarland and Tulare, Calif. Organized April, 1921. Bus. vol. C. Officers: J. S. Caldwell, President; B. L. Hughes, Secretary and Treasurer; W. M. Jagger, Assistant Secretary. Major contracts: for the State Highway Commission, 8 miles at Tracey, 13 miles at Salida, 17 miles in Merced County; also paving in McFarland, Colusa County, Merced City and Tulare. Member: Visalia Chamber of Commerce, Highway Development Association and U. S. Chamber of Commerce and No. California Chapter of A. G. C. of A.

James Collier, Denver, Colo., 1 E. Bayaud Street. Organized January, 1915. Major contracts: F. A. P. 286 B, grading and structure, Nunn, Colo., to the Wyoming line, 20 miles; Improvement Districts of Denver and Ft. Collins, Colo. Member: A. G. C. of A.



A Novo Sand Pump Owned by J. F. Ange, Orlando, Fla., Being Used for Fill-in Work. A Novo Single-Cylinder, Double-Acting, Piston Pump Supplies Sufficient Water and Pressure for Loosening Material Around the Suction Pipe

Sand Pumping for Producers

PUMPS that are used for handling sand may be classified first as producers of sand and second, as units for dredging and filling. Under the first, that of producing sand, Novo direct-connected sand pumps, made by the Novo Engine Co., Lansing, Mich., are frequently used because of the low initial expense and moderate cost of operation. Because of the fact that the largest size built by Novo is a 6-inch pump, its use is naturally limited to moderate size plants where, for example, the production required is not in excess of 300 to 400 yards per day.

To remove sand by the hydraulic method, it is necessary that the deposit be submerged, as water is the carrying medium. Moreover, agitation may be necessary, unless the deposit is loose and easy to remove. Agitation is always necessary when the deposit is in clay. For such work a small pressure pump will usually furnish sufficient force by means of jets to allow material to enter the suction. A non-rotating cutter on the end of the suction pipe will also assist in loosening material.

Needless to say, the suction pipe of a sand pump should be as short and straight as possible. No more elbows nor fittings than necessary should be used and the joints should be kept perfectly tight. It is advisable to use a vacuum gage on the suction line close to the pump and a pressure gage on the discharge line. A vacuum gage, which is usually calibrated in inches of mercury, determines the suction head, which item is extremely important in handling sand.

Correct velocity of water is essential for handling sand and should not exceed 15 feet per second. The velocity, however, should not fall below 8 or 10 feet per second because at low speed sand will settle in the discharge and suction pipes, restricting the flow of water and the operation of the pump.

Material is usually pumped direct to the screen and dewatering tank arranged at some height above ground, where it is stored and then lowered by gravity to storage bins or to cars or trucks. Water is ordinarily returned to the pond by sluiceways. As the material is pumped with about ten times its volume of water and becomes thoroughly agitated through the pump and pipe lines, it usually requires no further washing after dewatering.

The same type of pump as for excavating sand is successfully used for fill-in work. In fact, except for the fact that a pump doing this class of work usually operates at very low head, the installations are identical.

Inexpensive barges built on empty steel barrels have an A-frame at one end, which is used for holding the boom or lowering and raising the suction pipe.

A small single-cylinder pressure pump is used to agitate the material so that it will flow freely into the suction pipe.

A New, Small, Light-weight Ditcher

ADDED to the line of chain-and-bucket trench excavators of The Buckeye Traction Ditcher Co., Findlay, Ohio, is a new light-weight service ditcher, Model-150. This small, portable unit is exceptionally flexible in performance, and has the rugged construction and economical working ability of the larger machines of this company. It is especially suited for operation in restricted quarters where big excavators are unsuitable.

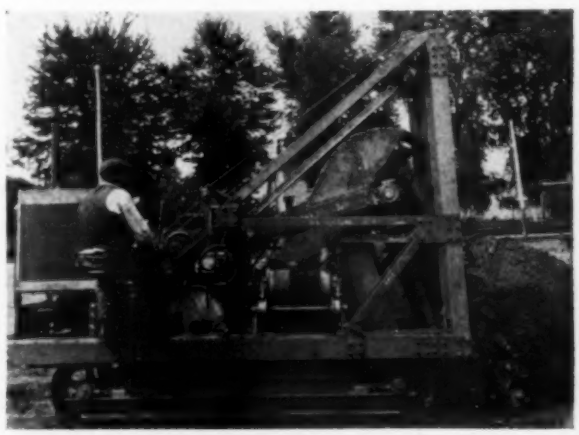
A unique feature of this ditcher is its reverse digging traction which enables it to dig while traveling backwards. This permits tunneling under side walks or other obstructions, or removing spoil where trenches have caved. The ditcher can dig straight down beside a wall or building, since nothing projects or is carried back of the bucket line. The crowding mechanism assures that the boom will not back away from the cutting face or raise on account of excessive traction feed.

The cutting widths of the ditcher are 16, 18, 20, 22, 24, and 26 inches, and cutting depths 0 to 4, 6, and 8 feet. The machine is of 98 per cent steel construction, excluding the power unit, is one-man operated and all control levers are within easy reach.

The ditcher is mounted on two full-length Alligator (crawler-type traction) wheels, with electric heat-treated steel treads. Each wheel gives a bearing pressure of 7 pounds per square inch. The wheels are equipped with drive sprockets, so designed that any certain tooth engages the tread at each alternate revolution only. Treads have smooth contact surface, but can be fitted with mud lugs.

The steering is by two Twin Disc friction clutches, each equipped with a band brake that automatically sets when the clutch is released. The machine may be turned completely around in its own length or make the slightest deviation in the line of the trench.

The excavator boom is of box girder construction. It is extremely rugged and capable of withstanding the severest



The New Buckeye Model-150 Service Ditcher

2300 yards of Concrete in 7 days, 8 hrs. with a 14-S

"We believe we made a record—"

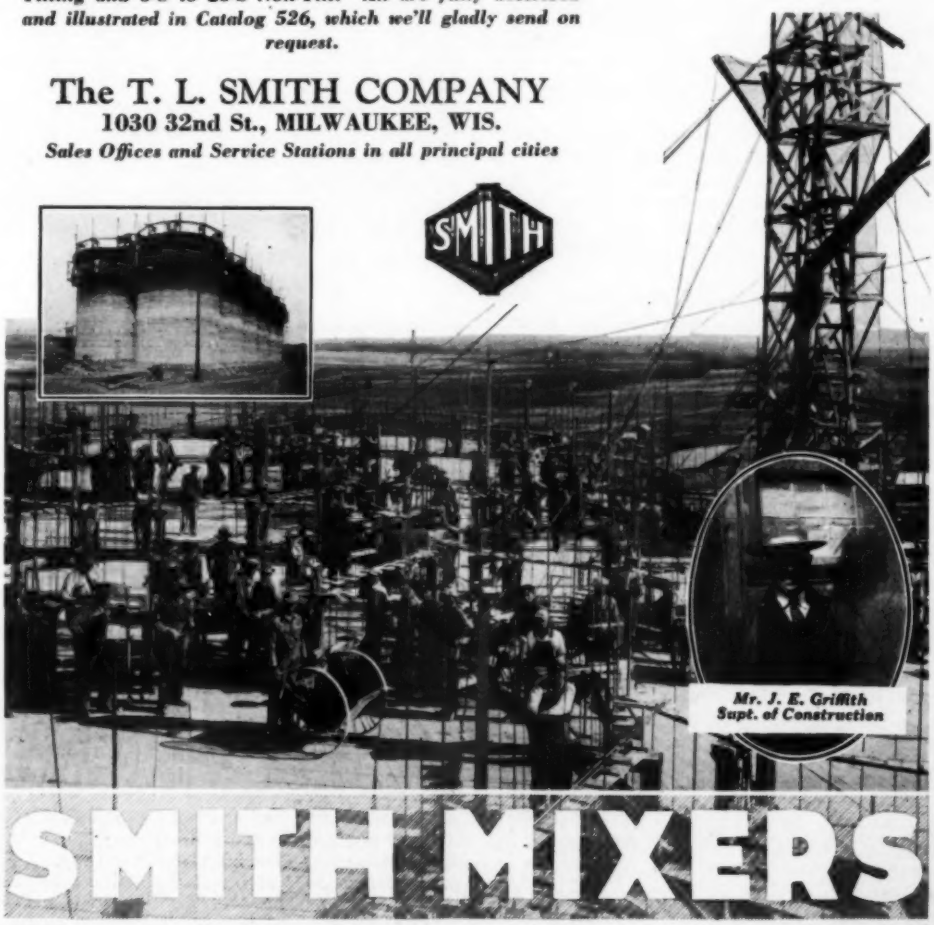
COLORADO PORTLAND CEMENT CO.

"THE 14-S Mixer used on this pour," writes Mr. Van Zandt, Chief Engineer, "ran continuously during this period, 24 hours a day, with the exception of a half hour at noon and at midnight when the men ate lunch. Throughout the pour *the limiting feature was the rate of placing reinforcing steel in the forms.* This job was done under the direction of Mr. J. E. Griffith, our Supt. of Construction, who has had a long and successful experience in the construction of cement plants."

The experienced and successful record breakers, those who pour concrete at the lowest cost per yard, know the dependability of Smith Mixers. The total concrete in this Boettcher, Colo., plant is 21,000 yds., of which a 14-S Smith poured 16,000 and a 7-S Smith (both Non-Tilters) mixed 5,000.

Smith Mixers are made in sizes from 2½-S up to 112-S Tilting and 5-S to 28-S Non-Tilt. All are fully described and illustrated in Catalog 526, which we'll gladly send on request.

The T. L. SMITH COMPANY
1030 32nd St., MILWAUKEE, WIS.
Sales Offices and Service Stations in all principal cities



shocks and strains of any practical machine digging. Buckets are one-piece electric cast steel, annealed and self-cleaning. Two bucket line speeds provide the greatest operating efficiency in all soils.

The excavator drive shaft is so built that it is not necessary to remove the bucket-line drive sprockets from the shaft when changing bucket sizes. The drive sprockets have easily removable and reversible teeth, of which only 6 of the total of 18 are engaged at any one time.

A safety sprocket is provided at the end of the excavator shaft to avoid severe breakage in case an overload obstruction is encountered. This sprocket releases upon meeting such an obstruction, but automatically returns immediately to its normal working position.

The conveyor is reversible and quickly shifted and driven from both ends by endless steel chains. It is kept centered by simple guide clips. Shifting is by power, less than 30 seconds being required to change the delivery position.

The motor is of the heavy-duty tractor type, developing 52 B.H.P. at 900 r.p.m. It is mounted with its transmission and clutch on a solid cast and finished subbase, providing a rigid assembly that will not get out of line.

Cost Data on Staten Island Boulevard Excavation

INTERESTING cost data covering trench excavation on Hylan Boulevard, Staten Island, N. Y., shows that the actual cost of excavating, figured on an average for the whole job, excluding depreciation and overhead, was 3.9 cents per lineal foot, compared with a cost of 8 cents per lineal foot with overhead included. The work was done by a new Bay City tractor shovel, with trench bucket, owned by Ialenti Brothers, operating under a subcontract for Knight & Demicco, Staten Island contractors.

In figuring the excavating cost and high depreciation, an interest charge has been set up and a charge of 50 per cent for overhead is included. These charges could be cut in half and still be safe but contractors, operating on Staten Island, N. Y., are accustomed to figuring high overhead. The operator's wages of $12.50 per day could also be cut to around $8.00 a day for other territories.

The soil condition was hard packed earth, some gravel, some boulders weighing up to half a ton, some spots inclined to be like a medium hardpan, and other spots having quicksand bottom. The backfilling was done by a Fordson tractor with a Baker-Maney backfilling blade attached to the front of the tractor to push the material into the trench. An 18-inch bucket with an actual width of 21 inches was used, and the average depth of the trench was 5 feet. The daily average was 500 feet per 8-hour day, less 1 hour waiting time for the pipe crew to keep up with the work, or 500 feet in 7 actual digging hours. Twelve-inch cast iron pipe, in 10-foot lengths, was used for the high pressure water main.

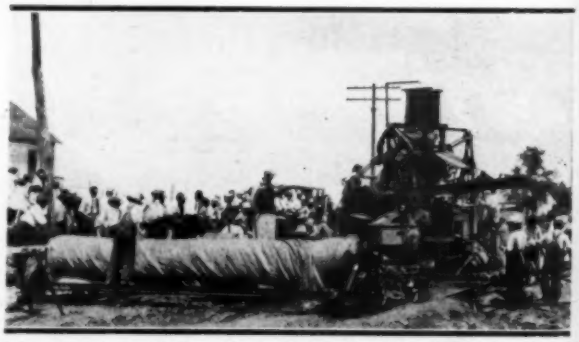
The labor on the job consisted of one operator on the ditcher; six men laying pipe, leading pipe joints, backfilling by hand to just cover the iron pipe to prevent breaking the pipe if a rock rolled back into the ditch; one operator on the backfiller; and the contractor, who was his own superintendent.

The actual cost of digging was 8 cents per foot of trench; of laying pipe and making joints, 12 cents per foot; and of backfilling, 5 cents per foot of trench, based as follows:

To dig trench—1 operator at	$12.50	per day
15 gal. gas at 20 cents	3.00	" "
1 gal. oil	1.00	" "
Maintenance	3.00	" "
Depreciation and Interest on Investment	7.50	" "
50 per cent for Overhead	13.00	" "
500 ft. daily totals	$40.00	
To lay pipe—6 men at $7.50 per day	$45.00	
Overhead	15.00	
500 ft. daily totals	$60.00	

Bay City Tractor Shovel with Trench Bucket Working on Sewer Trench on Staten Island, N. Y.

To backfill—1 tractor operator at	$8.00
Gas and oil	3.00
Depreciation and Interest on Investment	4.00
Overhead	10.00
500 ft. daily totals	$25.00

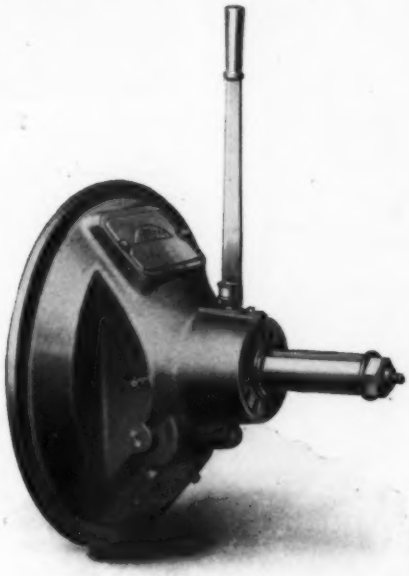


The American Paving Corporation, Omaha, Nebraska, Used This 20-Foot Roller Made of Ordinary 2-Inch Pipe for Handling Burlap on a Recent Paving Job at Olathe, Kansas. The 18-Foot Wide Strips of Burlap Were Securely Sewed Together to Form Sections That Were 100 Feet Long. A Rolling Bridge Was Used to Support the Burlap When a Section Was to Be Lifted. Bearings for the Pipe Support Are Provided at the Ends of the Bridge. Weights Are Placed on the Free End of the Burlap to Hold It Down as the Bridge Is Rolled Along on the Forms. This Device Has Been a Great Time Saver

ANNOUNCEMENT

THE BROWN-LIPE GEAR COMPANY

is now prepared to furnish Industrial Clutches in various sizes and of advanced design and construction



A BROWN-LIPE GEAR INDUSTRIAL CLUTCH

The above clutch will be exhibited at the Annual Convention and Exposition of the American Road Builders' Association at Cleveland, Ohio, Jan. 9 to 13 next, where engineers will be pleased to explain its advantages to all who are interested, and to receive information about clutches needed for various power installations.

We will also exhibit at this time the following Truck Transmissions—Model 70, 7-speed Main Frame, Model 60, 3-speed Auxiliary, Model 51, 5-speed Unit Power, and Model 20, 4-speed Unit Power, as well as our line of Power Take-offs.

Be sure to see this up-to-the-minute display at *Booth W-W 70, in the West Wing.*

Anyone not attending the Road Builders' Exposition can secure full information on our products by writing us.

BROWN-LIPE GEAR COMPANY

SYRACUSE, N.Y.

NEW YORK CHICAGO DETROIT SAN FRANCISCO LONDON, ENG.

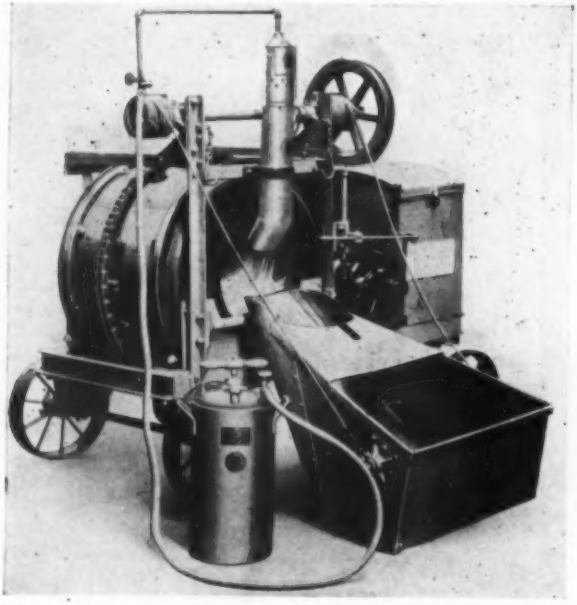
TRADE BROWN-LIPE GEAR CO. MARK

"Quality from first to last makes Brown-Lipe clutches unsurpassed"

Kerosene-Burning Concrete Heaters

KEROSENE-BURNING concrete heaters suitable for mounting on any make or size of mixer have been developed by Littleford Bros., 485 East Pearl Street, Cincinnati, Ohio. This new line of equipment includes units for application on either tilting-drum mixers or non-tilters.

With one of these heaters installed on a mixer, a mix can be discharged in zero weather at a temperature of 75 degrees Fahrenheit, according to the manufacturers. No additional



Littleford Concrete Heater Mounted on a Knickerbocker Non-Tilting Mixer

labor is required as the man who operates the mixer operates the heater.

The unit consists of a torch-type oil burner proper size, depending on the capacity of mixing drum, with fuel tank, oil hose, necessary fittings, elbow flame-deflector, and band for attaching to mixer. The installation is simple.

A simple valve adjustment regulates the flame to any desired size, and a windshield on the burner assures perfect operation under all weather conditions.

For Snow Removal and Excavating

SNOW removal and excavating jobs are made simple with the use of the North hydraulic digger, developed by the W. M. Blair Manufacturing Co., 3673 Michigan Avenue, Chicago, Ill. This is a heavy-duty unit designed for use on the Fordson tractor, which is the source of power. The digger lifts its load by means of a hydraulic cylinder which in turn receives its oil pressure from a rotary gear-pump driven direct from the Fordson power take-off. Every part is sturdily built to give continuous service on tough jobs. It offers a new unit in digging, loading, grading, backfilling, moving and handling of snow and excavated materials. It is simple and rugged in construction, can be operated by anyone and has no clutches or brakes to get out of order. It is made in two models—high-lift and low-lift.

Municipalities and large companies with snow removing problems are using the machine during the summer for all sorts of road and construction jobs, and in the winter use it for removing snow. Mounted on a Fordson, equipped with

The North Hydraulic Digger

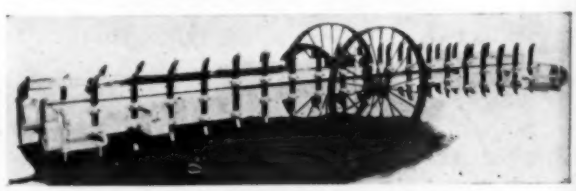
rubber-tired wheels so that the unit may move quickly for long distances under its own power, this machine will load 300 to 500 yards of piled snow per day.

By means of a small hand lever mounted on the right hand side of the dash, the operator has full control of the bucket. Raising, lowering or holding the bucket in any position is done by means of this control lever. The bucket is dumped by means of another lever, and the bucket is brought back to its locked position by dropping it to the ground. When the bucket reaches its extreme height and when it reaches its lowest position, it automatically stops.

The low-lift digger raises its load 42 inches and has a dumping clearance of 24 inches. This model is used for handling bulk material and it will pick up its load, transport the load 100 feet and handle at least 15 to 20 yards per hour. The high-lift digger mounted on the standard Fordson with rubber-tired wheels, raises its load 90 inches and has a dumping clearance of 76 inches. The standard bucket capacity is 1/3 yard. The high-lift model is also mounted on the Fordson with Model-F or Model-D Trackson crawlers, or on H. P. Rigid Rail tracks.

A Sub-Grade Scarifier

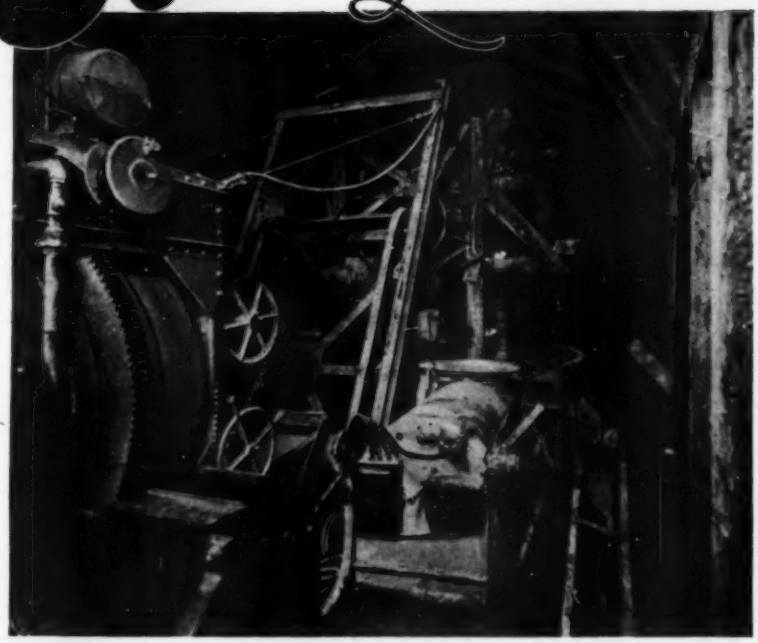
A NEW subgrade machine called a True Grade scarifier has been developed by Ted Carr & Co., 939 West North Avenue, Chicago, Ill. It is adapted to run on the forms and scarify the subgrade to an exact depth for highway construction. It is intended to cut high places off the hardest subgrades, and is built so heavy and compact that before any one scarifier tooth could raise up, it would have to lift half the weight of this 2-ton machine.



The New Carr Scratch Template

The frame is adjustable to different widths of road from 16 to 24 feet. It carries 47 double-end plow steel sacrificer teeth, so arranged that there is ample room for earth to pass between them while at the same time they come in a new path on the return trip so that they have scarified the ground every 3 inches. Wheels with powerful lift springs are provided at the center to enable the operator to raise it up and turn it around or run it off to one side.

14 Ransome Pneumatic Placers for A. Guthrie & Co.



Ransome Horizontal Pneumatic Shooting Concrete into the Cascade Tunnel

In the May, 1927 issue of the CONTRACTORS AND ENGINEERS MONTHLY, we used the heading "Nine Ransome Pneumatic Placers for New York Subway Work."

We thought this was a pretty good showing, although the nine placers were divided among several contractors.

Now *one* concern, A. Guthrie & Co., Inc., of St. Paul, has contracted with us for *fourteen* placers.

Six are already at work on the Cascade Tunnel of the Great Northern Railway, Scenic, Wash., and three on the Illinois Central Tunnel at Ozark, Ill.

Five more are to be shipped to the Cascade Tunnel early in 1928.

If you have a tunnel to line, or any similar work, give us the answers to the questions below:

1. Length of tunnel, end to end.
2. Length between shafts.
3. Height and width in rough.
4. Height and width, finished section.
5. Minimum thickness of concrete and point at which it is found.
6. Amount and location of reinforcing.
7. Is tunnel in rock or earth?
8. Will tunnel excavation be completed before lining?
9. If mucking, while lining, must muck cars pass through forms?
10. If in soft ground, will concreting follow up behind heading?
    Estimated Distances.
11. Length of form used, steel or wood, and print of same.
12. Type of concrete cars. Height and width.
13. Locomotive (if used). Height and width.
14. Size and kind of gravel or stone used.
15. Compressed air available in cubic feet per minute.
16. Will drills, air hammers, etc. operate from this supply when blowing concrete?
17. Gauge and size of track used.
18. Electric current available for operating motor.
19. How much yardage to be placed by air is involved?
20. Make sketch showing measurements mentioned in 3, 4, 5 and 6.

Name of Contractor or Engineer.....

Address .....

Location of Job .....

Mail This Coupon

Ransome Concrete Machinery Company

1850—Service for 78 Years—1928

Dunellen **New Jersey**

A One-Bag Standard Mixer

A NEW 5-S one-bag concrete mixer built to the standards of larger mixers has been developed by the Ransome Concrete Machinery Co., Dunellen, N. J. It has been designed especially for the smaller contractors who want a one-bagger built to the standards of larger mixers and for the large contractors who want a small mixer built to high standards.

The drum of the new mixer is 42 x 30 inches, with unusually

The Newest Ransome—a 5-S Skip Loader

large rounded corners to facilitate quick mixing with easy cleaning. It has ample room to handle a one-bag batch of 1:2½:4 mix. The charging chute is large and shaped to give rapid charging with wheelbarrows. The power loader takes a full load without crowding, and goes up in five seconds, while the discharge takes place in six to seven seconds.

The operation of the mixer is simple, all control levers being at the drum end, and the operator sees both the power loader and the discharge. The gears are unusually quiet in their operation. The Alemite system of lubrication is used. The frame is simple and rugged, and the mixer is easily moved, the front wheels turning under the frame.

A single or 2-cylinder Le Roi or Novo engine, or an electric motor, is supplied, as desired.

A Bottom-Dump Trailer for Heavy-Duty Tractors

A 5-TON, all steel, 4-wheel bottom-dump trailer, the MD-7, for use with heavy-duty tractors, has recently been added to the line of The Miami Trailer-Scraper Co., Troy, Ohio. When used for train operation, it is necessary to mount an extra hitch connector on the rear of each trailer. The low loading height of the trailer, which is only 64½ inches from the ground to the top of the body, makes this trailer desirable for use under steam shovels, elevating loaders, or for hand shoveling purposes.

The body of the MD-7 has a water level capacity of 3 yards and will carry a full rounded load or from from 4 to 4½ cubic yards. The dumping device is so constructed as to

The New 5-Ton Miami All-Steel Bottom-Dump Trailer Hauled by a Cletrac Tractor

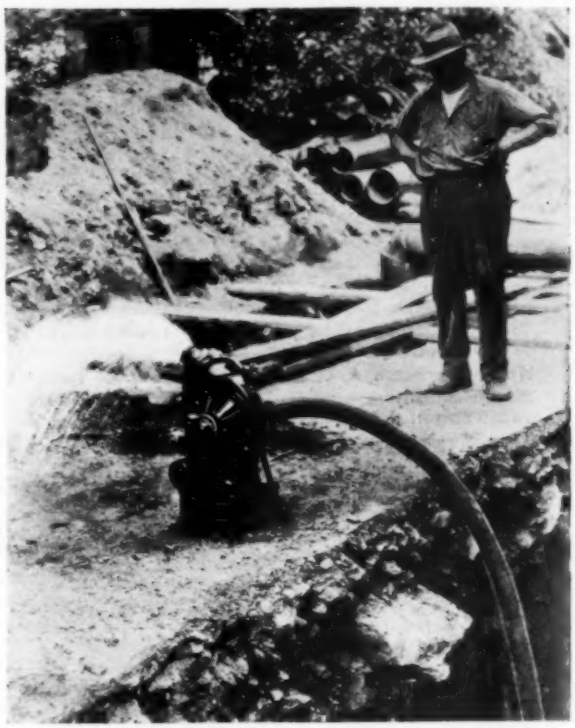
control the opening of the bottom doors. This control enables the operator to open the doors 6, 8 or 10 inches as may be required to spread the load as the tractor moves forward. On the other hand, the entire load may be dumped instantaneously should this be desired.

The trailer is of all-steel construction and the French & Hecht steel wheels are each equipped with two Timken tapered roller bearings, providing fully against end thrust both inward and outward. The fifth-wheel construction is of full cut-under type and is so designed that the front wheels will turn completely under the unit even with the bottom doors open, providing an exceptionally short turning radius—the trailer will turn in its own length.

For general hauling purposes, this company also manufactures this same trailer chassis constructed with a stake platform body. This chassis construction being the same as the dump trailer, the platform trailer has the short turning radius. It also may be operated in trains behind the heavy-duty tractors.

A 95-Pound Pumping Unit

A NEW portable centrifugal pumping unit, weighing 95 pounds with a capacity of 7,500 gallons per hour, has been developed by the Homelite Corporation, Port Chester, N. Y. This unit consists of a high efficiency centrif-



The 95-Pound Homelite Pump Unwatering a Trench

ugal pump with bronze open-type impeller direct-connected to a 1½-horsepower, single-cylinder, air-cooled motor, operating on gasoline or kerosene.

The pump and engine are mounted on the same base, which also acts as a fuel tank, holding one gallon—sufficient to operate the engine for four or five hours. The single shaft runs on oversize Norma Hoffman ball bearings. The pump suction and discharge are 2 inches in diamter. The lift of the pump is 20 feet; head, 45 feet. It will handle muddy, gritty water, oils, chemicals or anything that will pass through the foot valve strainer.

The engine is air-cooled and the outfit is independent of cooling water supply and can be used even in the lowest

Tarvia "RE-TREAD"

Before completing your 1928 plans, acquaint yourself with our method of utilizing this product for salvaging and rejuvenating old highways.

Costs are surprisingly low. Results — uniformly satisfactory.

There is a Tarvia Representative nearby who will gladly discuss the detail with you.

A post card to our nearest office will bring him.

The Barrett Company

New York
St. Louis
Detroit
Youngstown
Chicago
Salt Lake City
Milwaukee
Syracuse
Minneapolis
Baltimore
Providence
Cleveland
Toledo
Buffalo
Philadelphia
Cincinnati
Birmingham
Bethlehem
Boston
Kansas City
Lebanon
Columbus
Rochester

In Canada:
THE BARRETT COMPANY, Limited: Montreal, Toronto, Winnipeg, Vancouver

©THE BARRETT COMPANY, 1927

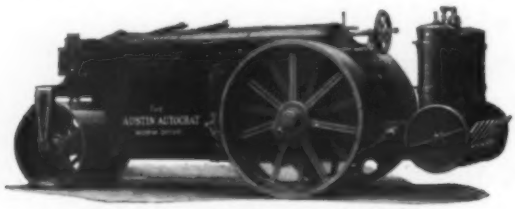
temperatures. Ignition is supplied by a Robert Bosch high-tension, damp-proof magneto.

The unit can be set anywhere without need for foundations, skids or blocking. Spring feet result in stability and absorption of vibration. The unit is especially adapted in unwatering excavations, pumping out cellars, manholes and sewers, filling tanks and boilers, handling oil and chemicals, irrigation, water supply, bilge pumping on scows and barges and fire protection.

A Motor Roller with Duplex Worm Drive

A NEW 10-ton, 4-cylinder motor roller with modern stream-line design and duplex worm gear drive has been announced by The Austin-Western Road Machinery Co., 400 N. Michigan Avenue, Chicago, Ill. This new machine has been designed especially for utility and efficiency and affords the operator an unobstructed view of both front and rear rolls and shields the motor and its component parts from dust, the weather and thievery.

The outstanding feature of the Autocrat, as the roller is called, is the duplex worm gear drive, by means of which the power of the modern, heavy-duty 4-cylinder motor is transmitted to the clutches, and thence to the rear axle. This worm



The New Austin Autocrat Gas Roller

drive is a new application so far as road rollers are concerned and is different from ordinary worm drives in two respects. The worm gear spiders are fitted to quills, or hollow shafts, carried on Timken tapered roller bearings placed within the gear housing. Within the quills are shafts carrying spur-drive pinions on one end, and, on the opposite end, the hubs which carry half the discs of the Twin-Disc clutches. The quills on which the worm gears are mounted carry the other clutch discs, and in consequence when one of the clutches is engaged—which automatically disengages the other—power is transmitted through one of the worm gears to one of the spur pinions, while the other spur pinion and its shaft rotate freely within the other quill. Both pinions mesh with a common driven gear; and, as the changed-speed gears are located between this common driven gear and the main drive gear on the rear axle, it follows that there will be the same traveling speeds forward and reverse—a necessary feature in a road roller which is working backward just about as much as forward. Furthermore, it also follows that it is not necessary to shift gears in order to change from forward to reverse or vice versa. Instead the operator simply disengages one clutch and engages the other, which is done with the utmost ease and speed, and the roller changes direction almost instantly.

Other distinctive features of the new equipment are: an electrically operated self-starter, actuated by a button on the control panel; an enclosed differential gear; oil and gasoline gages and all electrical controls are mounted on a panel directly in front of the operator's station, while all clutch, steering, gear shift and brake controls are also close at hand.

The motor is the heavy-duty Buda B. T. U. with 5-inch bore and 6½-inch stroke, giving 55 actual brake horsepower at 1,000 r.p.m., with extra large bearings and heavy, heat treated crank shaft drilled for force feed lubrication.

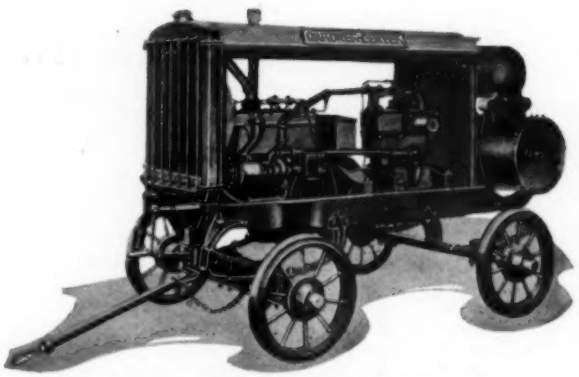
The pneumatic scarifier attachment is simple in design, strong in construction and very easy to operate. It consists primarily of an air compressor mounted on a plate directly over the engine flywheel housing, and driven by a belt from a pulley bolted to the pinion on the upper of the 2-clutch shafts. This compressor supplies air to two heavy steel 16 x 36-inch receivers which conform to all State and Federal specifications, and are mounted at the rear of the operator's platform. Air from these receivers is supplied to a cylinder mounted between them, and its force applied to the scarifier teeth or tynes by means of the 1-piece tyne holder, a heavy steel casting which is attached to the lower end of the cylinder piston through the medium of a strong steel connecting rod. Downward pressure of the air on the piston forces the teeth into the ground and holds them there, while by simply reversing the pressure and applying it to the lower face of the piston, which is of the trunk type, they are quickly raised.

Well-balanced Portable Air Compressors

THE portable gasoline-engine-driven air compressors of the Gardner-Denver Co., Denver, Colo., are amply powered, well-balanced units designed to meet the requirements of the wide variety of work to which they are applicable in the construction field.

In each unit, the assembly is carried on a single-piece, cast steel frame, to insure alignment and rigidity. A steel roof and removable side covers give ample protection from the weather. Power is supplied by a 4-cylinder, heavy-duty, "L"-head Buda gasoline engine, with a rated horsepower greatly in excess of the requirements of the compressor, assuring economical operation and long life.

These compressors, available in five standard sizes, are of the vertical, single-acting, duplex type. The lubrication is automatic and positive—a combination plunger pump and splash. The troughs are so constructed that a sufficient supply of oil is insured even when the machine is considerably tilted on uneven ground. The close grain, gray iron castings are accurately machined, and completely surrounded by a water jacket. The pistons are of the automobile type, light weight, and three rings are provided, the lower one arranged to prevent oil pumping.



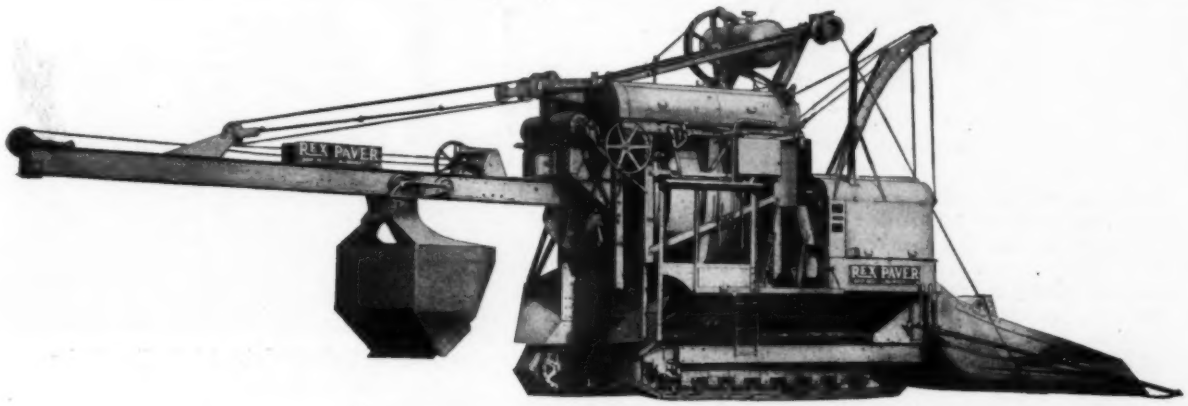
The New Gardner-Denver Portable Compressor

The unloader is operated in connection with the compressor intake valve. When the pressure in the air receiver reaches the "set" point, the unloading control valve allows air from the receiver to flow into pipes connected to plungers on the suction valves. These plungers hold the intake valves off their seats until the receiver pressure drops sufficiently. Simultaneously with the unloading of the compressor, an extension pipe to the carburetor operates an engine throttle control device, which automatically cuts the engine down to a low, economical idling speed.

More Than Ever
The Finest, Fastest Paver Ever Built

Two Greatest Paver Improvements

Since the Advent of the High Speed Idea



THIS year the fast operations that make Rex speed are put on an automatically maintained high-speed schedule—by the New Rex Mechanical Man (optional equipment).

The paver operator touches one lever and the charging water control, and discharging operations are performed automatically—without wasting a split second.

Forty more mixing minutes are given the paver drum each day.

And with The Mechanical Man is the micrometer controlled Rex high-speed water—that meets the strictest water specifications of '28 and years to come.

More than ever, the Rex 27-E is the Finest, Fastest Paver ever Built.

6 Operations Automatically

The Mechanical Man, at the touch of a lever, raises the skip, opens the discharge, closes the discharge, opens the water, shuts off the water, locks the skip in charging position. And all functions are overlapped to provide the greatest speed possible in any paver.

Micrometer Controlled Water

Set the Rex micrometer gauge to the exact water quantity that is called for. That quantity will be delivered on the next batch and succeeding batches. This water meets specifications of states demanding predetermined strength concrete.

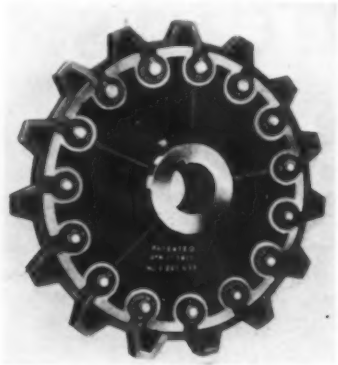
REX PAVERS

(Reg. U. S. Pat. Off.)

CHAIN BELT COMPANY, 766 Park Street, Milwaukee

Economy in Sprocket Wheels

CONTRACTORS will find a great economy in replacing a sprocket wheel broken in service by using the renewable-tooth sprocket for chain drives, as designed and produced by The Union Chain & Manufacturing Co., Sandusky, Ohio. This wheel can be furnished in any size for the larger pitch chains so that it can be used as a replacement part. It is made for large chains having a pitch usually greater than three



A New Development—The Renewable-Tooth Sprocket

inches, since it is on the larger and more expensive sprocket that a saving effected by its use becomes more evident.

Since in the case of a sprocket the teeth only are subject to wear, when the teeth are worn, causing loss of power and slipping and jerking of the chain, it has been necessary to replace the entire sprocket. Sometimes but one broken tooth, due to accident, has necessitated replacement of the complete unit. If the teeth only need be replaced, a proportionate saving results and the body of the sprocket itself lasts indefinitely.

In the use of this new renewable-tooth sprocket, the saving effected through retention of the sprocket, while appreciable, is not the greatest economy achieved. Rather, this lies in the saving of the time and labor consumed for the replacement of the ordinary sprocket. Very often the cost of the replacement, other than the cost of the sprocket itself, amounts to more than the cost of new teeth for the renewable-tooth sprocket, and these later can be inserted in but a few moments without even the removal of the chain.

The body of the sprocket wheel is of cast steel. The teeth are made of a very strong, wear-resisting alloy steel, insuring long service. These sprockets are made for large chains having a pitch usually greater than three inches. The bolts expand the circular ends of the teeth, which makes them practically an integral part of the body.

The sprockets are furnished either split or solid, although the latter are most generally used because of the permanent nature of the installation, since once they are installed their life is measured only by the life of the plant or the machine.

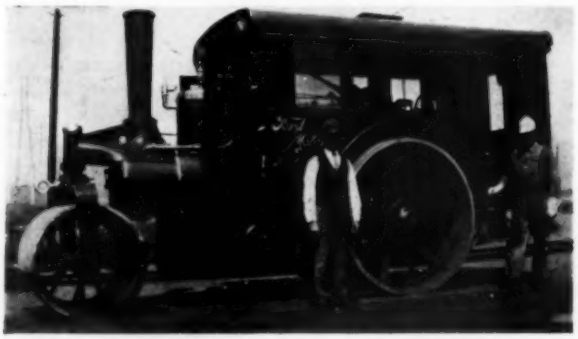
A Specially Designed Grading Roller

A SPECIAL grading roller that is capable of performing all of the functions of a standard grader as well as rolling and scarifying has been developed by The Buffalo-Springfield Roller Co., Springfield, Ohio. This has been designed for cases where the work of the roller and scarifier has to be supplemented by that of a hauled or power grader.

While the weight of this grading roller permits it to be used for rolling subgrade for concrete pavements, it has the weight and stability of the largest power graders. It is narrow enough to permit its use between forms of strip-built concrete roads and it is short enough to be turned on a 16-foot roadway. These features make this piece of equipment well suited for preparing the subgrade in front of the grader and also for shaping, rolling, and finishing the shoulders after the pavement is laid. If a subgrading machine is used, the grading roller will provide power for hauling it and for scarifying any hard spots encountered.

The maintenance of sand-clay, gravel, and broken stone streets and roads, involving occasional scarifying, reshaping and rerolling of the surface, can be done without the aid of any other machine and with but one operator.

The power and driving mechanism of the grading roller consists of a high grade 4-cylinder motor, the power of which is transmitted to the drive rolls through spur gears of large diameter and wide face. Provision is made for three gear speeds in both the forward and backward motion, giving a high ratio for difficult scarifying and grading and a low ratio for light work and travel from place to place. The machine is reversed entirely through clutches without change of gears, which is of much importance when operating in hilly country or on surfaces that are easily injured by too abrupt reversing.



The New Buffalo-Springfield Special Grading Roller

The operator's position is in advance of the power unit and over the grading blade where he has a clear view of the work of the blade. The drive rolls can be provided with picks or lugs to increase traction and are made in accordance with standard road roller practice.

The new machine can be furnished either with or without scarifier, air compressor and air tank.

Lubrication of Wire Rope

PROTECTION of wire rope against corrosion is afforded by the use of flake graphite and waterproof graphite grease of the Joseph Dixon Crucible Co., Jersey City, N. J. This flake graphite possesses the necessary body to protect the surface of the rope and to take the wear. It penetrates to the innermost strands, keeps them well lubricated, and thus minimizes internal friction. Being insoluble in water and unaffected by acids, alkalies, or corroding atmospheric conditions, it stays with the rope and guards it against these damaging influences. The graphite grease is for the most severe service. It is heavy bodied and adhesive and possesses high lubricating value.

For original lubrication it is well to pass new rope through a slotted box filled with the graphited grease. In this way, the rope will fill from the outside and the grease will find its way around every strand from the surface to the center. Once a rope is filled this way it will offer the least wear. Many practical rope men believe that the greatest wear takes place upon that portion of the rope that is at any time on the outside of the revolving sheave. The surfaces must be dry before this grease is applied or it will not adhere.

Waukesha-Equipped Universal Crane for Snow Loading

n-774-M

Saving Public Funds

The portable heavy-duty gasoline engine is the greatest man power and money saver known to the Industrial World. At Syracuse, N. Y., is the Waukesha-engined crane shown above. There, during one 50-hour blizzard, 36 inches of snow fell. Eight and nine-foot windrows, made by the plows, had to be cleared away in record time. Loading 9 to 10 yards every two or three minutes, this crane easily took the place of from 50 to 75 shovelers.

Cleaning up snow is an emergency job. Any delay means thousands of dollars loss to the public through the failure of their transportation systems. Waukesha engines are of the heavy-duty type, designed to do just such tough jobs. Contractors who have to meet penalties must not gamble with engines of questioned reliability. That is why you find them buying equipment powered by Waukesha "Ricardo Head" engines in preference to other makes. Let us send you "Industrial Units," a book showing some of the 32 different industries in which Waukesha power is used

N-803-L

INDUSTRIAL EQUIPMENT DIVISION

WAUKESHA MOTOR COMPANY

Waukesha Wisconsin

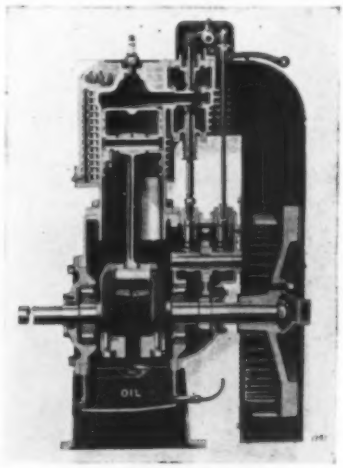
New York	Kansas City	Denver	Tulsa	Houston	San Francisco
8 W. 40th St.	*V. L. Phillips Co.*	*Wilson Machy. Co.*	*C. F. Camp Co.*	*Portable Rotary Rig Co.*	*C. A. Watts*

Exclusive Builders of Heavy Duty Gasoline Engines for Over Twenty Years

An Air-Cooled Engine for Construction Use

SUPERIOR efficiency is obtained by the use of air-cooled engines in construction as in motor vehicles and air craft. This type of engine has been developed by the New-Way Motor Co., Lansing, Mich., and it has been improved to a point where it is now standard equipment on a large variety of machines, tools and equipment.

In the contractors' field it is being used for running equipment for sawing, pumping, tamping, mixing, hoisting, grading,



New-Way Air-Cooled Engine Developed for Contractors' Use

conveying, loading, paint spraying, compressing, operating generators for running electric tools of all kinds, for flood-lighting, etc.

The "New-Way" engine is simple, compact, and, according to the manufacturers, delivers more power per pound weight than any other complete engine. A special patented air-cooled cylinder eliminates water and its attendant troubles, and permits heavy-duty service in any temperature. The intake is provided with an air cleaner. The engine is entirely closed and dust-proof, as every working part runs in a bath of oil. Speed is regulated instantly, and a convenient lever controls the mechanism of the implement being operated. A Bosch magneto and impulse starter, and a float-feed carburetor make for easy starting and operation.

These engines operate economically on gasoline, kerosene, natural gas, benzine, distillates, or alcohol. A patented direct air-cooling system keeps the cylinders at a higher operating temperature, thus assuring more perfect combustion and maximum fuel economy.

Every working part of the engine can be removed and replaced in a few minutes in the field with ordinary tools. Unit construction permits removing the crankshaft without disturbing the ignition, governor, valves or gears, and the connecting-rod bearings can be adjusted in five minutes.

Welded Roof Truss is Lighter Than Riveted Truss

THE development of a new design of roof truss that uses less metal at less expense, to withstand a given load in the construction of industrial buildings, has been announced by the General Electric Co., Schenectady, N. Y. This truss is fabricated by welding, instead of being riveted.

The new truss is the design of William Dalton of the manufacturing department of General Electric. Each truss consists of two parallel lengths of metal latticed together by a system of tension and compression members, rivets heretofore being used to fasten the units together. The amount of metal saved by welding as against the amount used where holes are punched, is equivalent to a strip of metal the full length and thickness of the part in which the hole is punched and as wide as the diameter of the rivet, according to the designer.

In the new truss, the two parallel members or cords are made of H-beams, the tension members are of channel iron and the compression members, H-beams. As an economical fastening is needed and as it is not easy to rivet such a combination of shapes together, welding is used to make the necessary connections. This also eliminates the use of gusset or connecting plates necessary for riveted joints. A comparison of the riveted and welded trusses designed for the same load and stresses shows that the riveted trusses are about 40 per cent heavier than the welded trusses.

Motor-Driven Shovels

NOISE and smoke are entirely eliminated in the new electric shovel being used at Fort Lee on the New Jersey side of the Hudson River Bridge, being built under the supervision of the Port of New York Authority. This latest development in the field of excavating machinery is the Marion Model No. 37, a ¾-yard revolving shovel, with a Westinghouse Electric and Manufacturing Co. motor.

Adhering to their policy of taking into consideration the territory where their contracts call for operation, the contractors for the Fort Lee job, Foley Brothers, sought this type of equipment for work in a residential section. A shovel that would be noiseless and smokeless was ordered from the Marion Steam Shovel Co., which in turn called upon Westinghouse for equipment that would power such a shovel. Power equipment for the severest application and ample speed was found in a special mill-type motor.

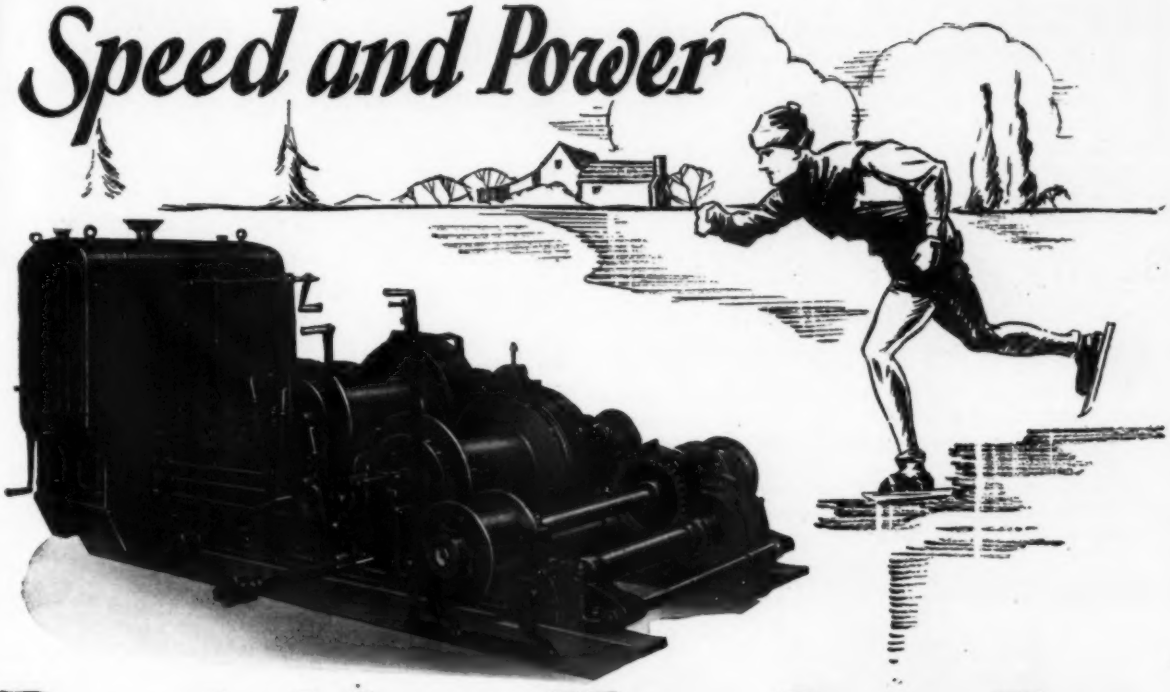
The motor is operated by variable voltage control. This affords all the speed range and all the flexibility of steam but does away with the chugging and hissing noises, eliminates smoke, and removes the annoyance of getting rid of the ashes incident to steam operation. This modern electric shovel should also be economical since no firemen are necessary for operation, there is no fuel to haul and handle, no problem of water supply, and no lost time waiting for steam pressure. When it

Marion Shovel with Westinghouse Motor

is necessary to operate the shovel in winter, as is the case in the Fort Lee job, the dangers of boiler and steam pipes freezing are eliminated.

Another electric shovel that is being used with a reduction in yardage costs is employed in digging sand and gravel in open quarries by the Consumers' Rock & Gravel Co., Los Angeles, Calif., according to *Electrical World*. For a typical month's operation on a 1¾-yard Marion No. 37 electric shovel and a 1¾-yard steam shovel handling practically the same tonnage, the power cost for the electric shovel was 0.327 cent per ton as against a cost of 0.953 cent per ton for the steam shovel. Moreover, there was a labor saving of $410.87 for the month in favor of the electric shovel, making the net tonnage cost for

Speed and Power



Puts the MUNDY HOIST Out in Front

THE demons of the ice rinks—who are out in front when the flag falls at the finish line—are endowed with generous reserves of speed and power. They not only possess these qualities, but what is absolutely essential to winning form, they have learned to co-ordinate the two so that each is supplementary to the other. Speed or power *alone* is not enough—but put them together and you have a winning combination.

TRADE MARK MUNDY ESTABLISHED 1869

To Equipment Distributors

The New Patent Three-Speed Hoist is fully protected by patents in the United States and Canada.

Some open exclusive sales territory is now available.

A combination of speed and power is not so rare in athletes. The champions of practically every sport are liberally endowed with both. That's why they are champions.

But in hoists it is not so common. Most hoists are powerful, but most of them are also slow and ponderous. The Mundy Three-Speed Hoist is the champion of its field because it is the only one in which the winning combination of *speed* and *power* has been successfully co-ordinated.

The three speeds of the Mundy Hoist give it a range of performance to handle every kind of load with maximum efficiency. The Mundy has power for the heaviest loads; and at the same time it has *speed*—to handle the lighter loads with swiftness and precision.

A simple shift of a lever and a different speed and line pull is secured. No reaving changes with the Mundy Hoist. Shall we send you the full details?

The Mundy Sales Corporation

Distributors for the J. S. Mundy Hoisting Engine Co

30 Church St., New York

Agents in Principal Cities

MUNDY HOISTS

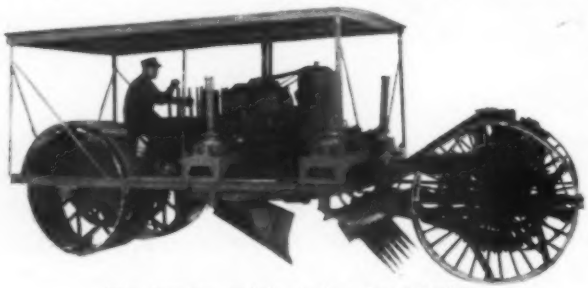
the electric shovel 1.67 cents as compared with 2.595 cents for the steam shovel.

Power for the electric shovel operation is purchased from the serving utility at 2,300 volts, 3-phase, from a metered line that parallels the gravel quarry. A bank of three 50-kva. transformers is mounted on a small car, which has standard light railroad rolling stock and is advanced every few weeks by extending the temporary track. The high-tension connection to the transformer is made with overhead service wires, and power at 440 volts is fed to the shovel by a 3-conductor No. 1 rubber-insulated portable cable 550 feet in length.

Scarify, Grade and Roll in One Operation

A TRIPLE action road builder, the Greyhound, that scarifies, grades and rolls at one time, one operation and by one man, has been put on the market by The Banting Manufacturing Co., Toledo, Ohio. This machine is propelled by a 4-wheel drive unit and equipped with a 60-horsepower, 4-cylinder motor.

Mechanical devices for hoisting and lowering the scraper and scarifier are conveniently operated from the driver's seat. The grader blade can be changed to any angle, or to deliver



The Banting Triple Action Road Builder

the dirt from the right to the left side of the machine. The power is distributed equally to the four wheels, the front driving power being hung on a frame separately from the rear, permitting either the front or rear of the machine to travel over uneven roads without getting any parts out of line and without undue strain on the frame.

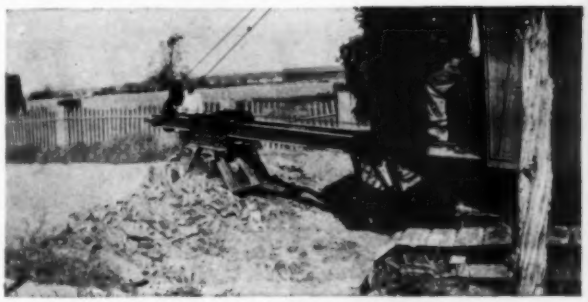
The hoisting screws hold both the scraper and scarifier firmly in any position desired, and neither can be forced up or down by different soil conditions. The scarifier teeth are held in the socket by a spring tension requiring only a half-inch bolt for each tooth, making it possible to change the entire set in a few minutes.

The transmission has two speeds forward and one reverse. Low speed forward is 1¼ miles, high 4 miles, and reverse 3 miles per hour. The machine has ball-bearing transmission and all gears hardened and ground with a 2-inch face. A vacuum in the transmission forces a constant flow of oil to all parts, including the uppermost parts.

Skimmer Scoop Has Three Special Features

A NEW skimmer scoop has recently been developed by the Speeder Machinery Corporation, Cedar Rapids, Iowa. It features high and low speeds on the drums as well as on the traction, a patented bucket trip, a traction lock and a bucket that dumps from the back instead of the bottom.

This skimmer's trial test was at Santa Fe, New Mexico, where L. E. Whitman and Co., the owner, was tearing up an old hand-laid rock pavement preparatory to laying a new pavement. Here, the value and extent of the power to be obtained by the high and low speeds on the drums and the usefulness of the traction lock, which prevents travel away from the work



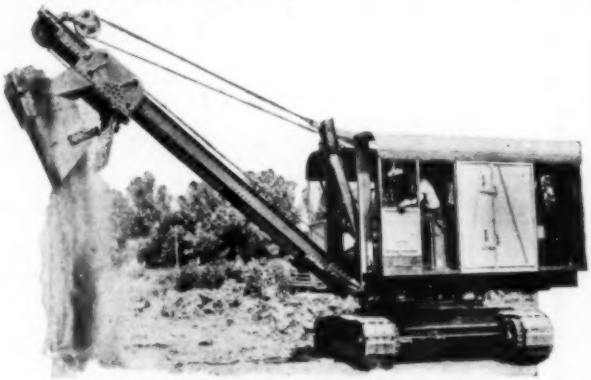
The New Speeder Skimmer Scoop on Grading Operation

and yet allows movement towards it, were demonstrated. On this job, exceptional headway was being made in high speed when suddenly the scoop encountered what apparently was an unusually large and deep seated rock. The operator reverted to low speed and the machine, weighing 14 tons, skidded itself backwards several inches before the operator realized he had encountered a hidden manhole.

The patented trip on the bucket eliminates the use of a trip rope. It permits dumping the bucket in any position. This feature is advantageous while working on narrow streets or in close quarters.

The back-dump feature, which is made possible by placing the pivots near the top of the bucket instead of the bottom, gives a dumping clearance greater than could be obtained with a bottom dump. This feature should add to the life of the bucket by eliminating the hinge on the bottom, which carries the greatest load.

The skimmer scoop embodies all the features of the other products of this company—shovels, pull shovels, cranes, draglines and back-fillers—and the change to the skimmer from any other Speeder attachment is accomplished by simply changing the boom and rereeving the cables. It is a full revolving machine, giving a wide work-range and permits wagons and trucks to be loaded from the rear.

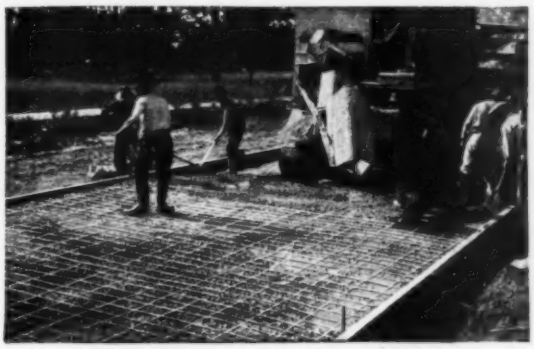


Method of Dumping the Speeder Skimmer

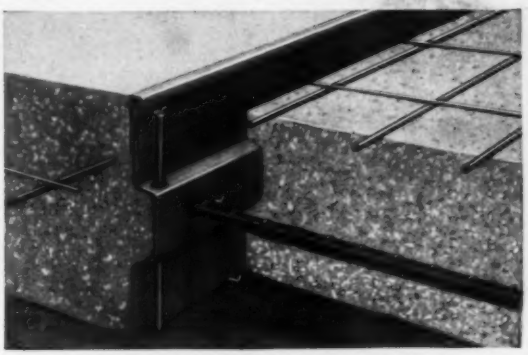
A 6-foot turn-table and extra large crawler base gives sufficient stability for the use of an 18-foot boom, enabling the bucket to fill on very shallow cuts and giving an added height to the dumping clearance. A center post, 6 inches in diameter, along with sturdy construction throughout the entire machine, absorbs the shock which is thrown upon the machine when used as a skimmer.

Hydraulic Dirt Mover Breaks Records

RECORDS in dirt moving have been broken by a new hydraulic dirt mover designed by W. K. McMillen, a contractor of San Francisco, Calif., in collaboration with prominent mechanical engineers. One of these earth movers



WELDED STEEL FABRIC



DOWEL CONTRACTION JOINT

Trusconize Roads & Streets for Permanency

Truscon Products for reinforcing concrete roads and streets add materially to their life and cut down maintenance expenses. There is a Truscon Product to meet every need for concrete road reinforcing and construction:

Truscon Welded Steel Fabric

binds the concrete into a crackproof unit mass that will withstand the onslaughts of time, traffic and the weather.

Truscon Dowel Contraction Joints

to provide a definite plane of weakness in the pavement that forms a straight, regular crack when the concrete slab expands or contracts.

Truscon Curb Bars

give additional life to the corners of slabs and curbs by preventing wearing and chipping.

Truscon Steel Road Forms

enable the contractor to give a speedier, cleaner job in less time and at lower cost.

TRUSCON STEEL COMPANY, YOUNGSTOWN, OHIO

Factories at Youngstown and Los Angeles
Warehouses and Offices in Principal Cities

ROAD FORMS

CURB BARS

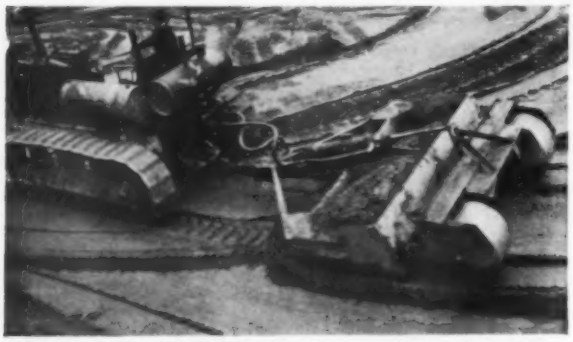
COMPLETE
Engineering Service
FOR ALL
Airport Requirements

TRUSCON

See these products at the Road Show in Cleveland, January 9th to 13th at BOOTH AA-3

1903 TWENTY-FIVE YEARS OF PIONEERING AND LEADERSHIP 1928

STANDARD
Airplane Hangars
AND OTHER
Complete Buildings



The Hydraulic Dirt Mover Operated by a Caterpillar Tractor

and a Caterpillar Sixty tractor moved 5,700 yards of earth in 15 days on a 250-foot haul.

This new earth mover was designed especially for operation by a Caterpillar tractor and is operated entirely by the tractor driver. The operator has entire control over the operation of the unit by means of simple, hand-lever control. The machine moves exactly to the point desired, does not shift, and operates on the simple principle of a door hinge. The wheels are mounted on anti-friction bearings with facilities for high pressure lubrication, using the same fittings as are used on the tractor.

Fewer Parts in New Shovel-Crane

ONE of the latest additions to the line of shovels, cranes, derricks, etc., of the American Hoist and Derrick Co., 63 South Robert Street, St. Paul, Minn., is a shovel-crane, named the "American Gopher." Ruggedness, speed and adaptability are the features which make it especially suited for crane and dragline service. According to the manufacturers, this new machine has fewer parts than is usual in equipment of this character.

The shovel-crane is the crawler type and is equipped with continuous chain treads, which enable it to travel over all types of ground, from mud to soft sand. The treads are flat and will not harm pavements during transportation. Holes in the treads make it possible to apply cleats when it is necessary for the machine to travel over slippery places.

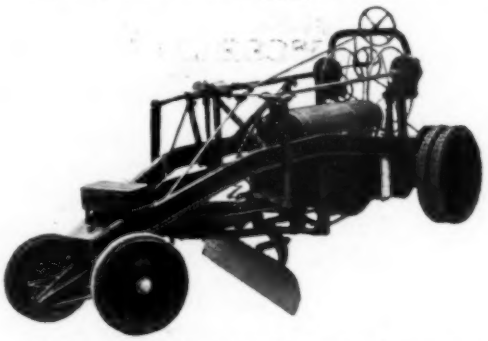
The new equipment has high pressure lubrication, S. K. F. bearings and parts that are interchangeable wherever possible. In order to meet the demand for various kinds of power it is equipped for gasoline engine, diesel-power or electric motor.

The New American Gopher Diesel Powered Shovel-Crane Digging in Clay

A Motor Grader with 2-Ton Tractor

A NEW motor grader which has an improved method of attachment to the tractor and heavy double springs of ample proportions and is of heavy frame construction throughout has been developed by the Spears-Wells Machinery Co., Inc., Oakland, Calif. The method of attaching the Model 28C, "Big 8" grader to the tractor provides and controls the proper movement between the front end of the tractor and the grader frame. The heavy double springs are used to control the vertical movement while the rollers and guides between the tractor and grader take care of the horizontal or side thrust and also insure uniform and accurate vertical movement.

The large rubber-tired front wheels are 29 x 5 inches. The new steering device, the Hannum patented heavy-duty truck type completely enclosed cut gears, have only one universal



The Spearwell Big 8 for International Tractor

joint in the control rod. All the gears used on the grader or scarifier attachment are of cast steel and are either cut or ground. The blade lift gears and worms are enclosed and run in oil.

The hand wheels are within easy reach of the operator. A heavy spring on the king bolt above the blade drawbars eliminates chatter. There is an offset cranking device on the tractor. The blade circle is completely reinforced so as to be practically unbreakable. The complete weight of the new motor grader with the tractor is now 10,200 pounds.

The new Spearwell "Big 8" International motor grader, Model 281, for the McCormick-Deering 10-20 tractor is very similar in design to the Model 28C and embraces the same improvements. The Model 281 now weighs, complete with tractor, 11,000 pounds.

A Diesel-Powered, Gear-Driven Locomotive

WHAT is believed to be the first diesel-powered, gear-driven locomotive built in America, has just been brought out by the Plymouth Locomotive Works of the Fate-Root-Heath Co., Plymouth, Ohio. It is a 10-ton, 4-cylinder, 4-cycle, enclosed type Atlas-Imperial full diesel engine, 6½ x 8½ inches, developing 77 horsepower at a speed of 650 r.p.m.

The first three of these locomotives were shipped to the Kaiser Paving Co., Oakland, Calif., prominent Pacific Coast contractors. One of the locomotives handled 6 cars of gravel —the total weight of the cars and load being 144 tons—up a 3 per cent grade at a speed of 8.1 miles per hour. On a test anchored pull, the locomotive spun the drive wheels on a sanded track in second gear.

The big saving in fuel cost was the deciding factor in adopting this form of power. The cost of fuel oil varies from 3 cents per gallon on the Pacific Coast to 6 or 7 cents in the Midwestern States. The engine consumes from 2½ to 3½

WHEELBARROW ENGINEERING

FOR THE CONTRACTOR

There is a lot more to building a wheelbarrow than merely making and assembling a few parts. This Bull Frog No. 64 is a fine example of modern wheelbarrow engineering. It is not only a strong and rigidly built wheelbarrow, but it earns its cost in the greater results accomplished per hour or per day by the labor using it.

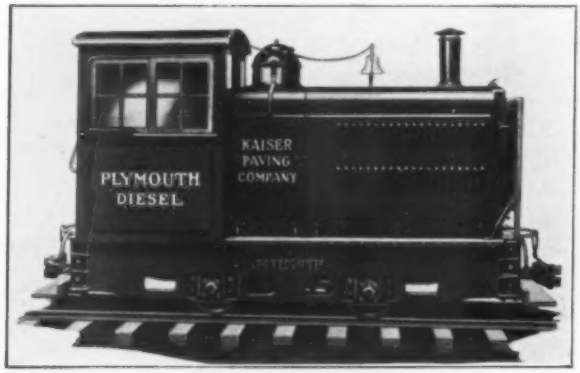
Noteworthy features are: an unusually high riser, carrying the narrow, deep, seamless tray well forward for easy dumping into forms; shaped handles; angle iron legs, extending along and reinforcing handles; "Never-Break," easy-running wheel and angle iron nose guard, renewable malleable iron shoes, easily replaced when necessary.

We will gladly send you our catalog showing specialized Bull Frog barrows, carts and scrapers for every purpose.

THE TOLEDO WHEELBARROW COMPANY
Toledo, Ohio

Branch Office and Warehouse
CHICAGO
69 E. Wacker Drive

BULL FROG WHEELBARROWS



New 10-Ton Plymouth Diesel Locomotive

gallons per hour, depending on the class of service, and the consumption of lubricating oil is stated to be somewhat less than in a gasoline engine of equal power. In the test made, one full tank of fuel oil, 50 gallons, lasted 16 hours of continuous operation, representing a fuel cost of approximately 10 cents per hour.

The engines are started by compressed air and a small combinded gas engine and compressor is fitted in the cab for providing the starting air. This unit is used for emergency only. The engine has built into it an air compressor that normally supplies all the air necessary for keeping the starting tanks filled.

The transmission follows the standard practice of the manufacturer, with sliding change gears that give 4 speeds forward and 4 reverse. A Twin Disc clutch is mounted on the front end of the transmission driven from a driving disc mounted on the engine crankshaft. The final drive from the transmission to the driving axles is by means of two short hardened steel roller chains.

A heavy cast-steel frame forms the structure upon which the engine, transmission, cab, etc., are mounted. The side frame members have suitable provision for mounting the roller bearing axle boxes. A Modine sectional radiator and a 30-inch, 8-bladed fan driven from the engine provide the necessary cooling. The braking is accomplished by means of hand-operated levers, although provision is made for the application of air brakes when required.

The weight of the locomotive ready for the rails is 20,000 pounds and the entire weight comes on the wheels as all are drivers. This gives a drawbar pull of 5,000 pounds on dry rails at 2½ miles per hour. Additional speeds of 4, 8¼ and 13½ miles per hour are provided. These locomotives will be made in a full range of sizes from 10-ton up to 50-ton, and the manufacturer announces that the larger sizes will soon be in production.

A Motor-Driven Arc Welder

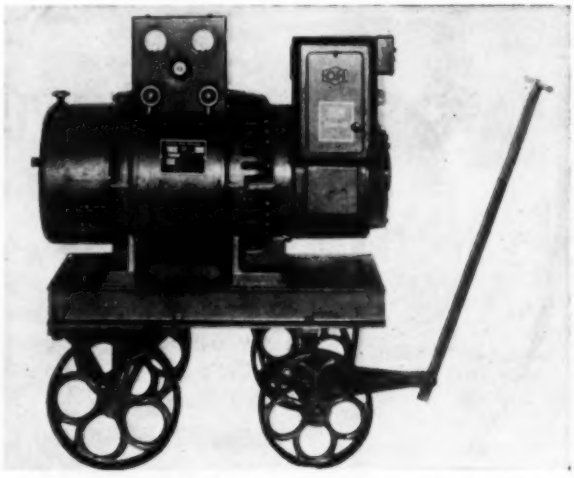
THE most recent addition to the line of arc welders of the Fusion Welding Corporation, 103rd Street and Torrence Avenue, Chicago, Ill., an engineering associate of the Chicago Steel & Wire Co., is a direct current machine operated by a 3-phase alternating current motor, at either 220 or 440 volts, both the welding generator and motor being mounted on the same shaft, making a 2-bearing unit.

The arc of this welding generator has stability and responds instantaneously to changes in arc length. It is possible to increase or decrease instantly the arc length by a half-inch without extinguishing it.

The new welder has no external stabilizer, no field rheostat and no separate exciter. These auxiliaries, especially the external stabilizer, introduce electrical inertia in the circuit so that the welding operator is really not directly connected to his source of current.

The flexible arc has an important significance to the contractor or owner of this machine. The training of new operators is eliminated. The arc is so flexible that a man who has never attempted welding before can completely melt an electrode the very first time he tries it without breaking the arc once. The operator, then, from the very start can devote his time exclusively to learning how to make a proper weld. On the other hand, the experienced man, while perfectly capable of maintaining the arc, is under a rather heavy strain at all times and this fatigues him, often without his realizing the fact. Even the most experienced operator will occasionally break the arc and the broken arc invariably makes a bad spot in the weld. This spot must be gone back over and recoopered, or, if allowed to pass, reduces the quality of the work. A short arc length always makes the best weld but an increase of arc length for an instant only is not noticeable in the finished product.

The elimination of the auxiliaries from the welder reduces



Motor-Driven Welding Generator with Flexible Arc

the weight and at the same time permits very rugged construction. There is but one control to govern the welding current. This control is accomplished not by means of rheostats, but, by a simple brush shifting device, which gives the welder a very wide range. The current can be varied from 50 amperes to 300 amperes and, over this range, the arc is equally flexible and stable. This is due to the fact that shifting the brushes not only controls the current going to the operator but, at the same time, and by the same control, alters the volt-ampere characteristic of the machine in such a manner that the most suitable characteristic is supplied at each current to which the machine is set. This permits welding metals from the thinnest to the thickest with equal facility by merely setting the current at the desired amperage.

Paper Bags for Portland Cement

ON a recent 13-story cooperative apartment job in Chicago, the contractors, Chas. J. Johnson & Sons, Inc., used 40,000 bags of cement delivered in Multi-Wall paper bags, made by the Bates Valve Bag Corp., Chicago, Ill.

Charles B. Johnson, head of the contracting firm, gives the following testimony regarding the use of Multi-Wall bags, "We have done this for the reason that by using cement in cloth bags, we were suffering a loss of an average of 10 cents a barrel a year, because we had to build a shed at each job to protect cloth bags. We could not get a refund on wet ones,

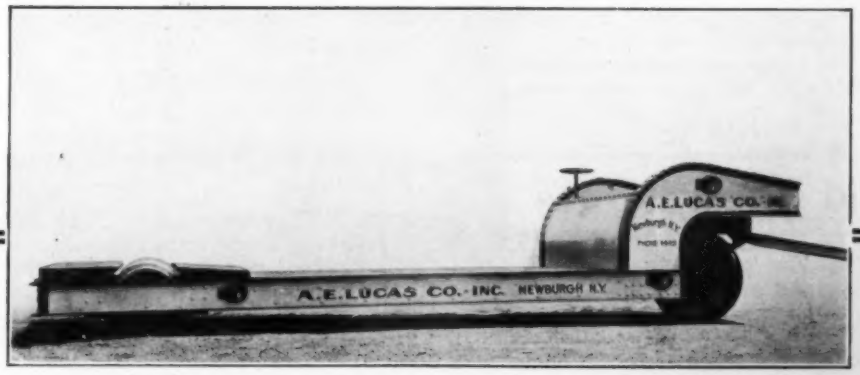
Here's a 40-ton Buckeye trench excavator to be moved. Are we going to have any trouble in transporting it to the next job? *We are not!* The trailer we're using is used to heavier loads than this! Even a 70-ton transformer can be easily moved on a

ROGERS
HEAVY DUTY
TRAILER

Below is shown a standard Rogers Trailer, "Gooseneck Type," with four rear wheels-in-line on 2 rocking axles. This trailer is easily and quickly loaded, and allows a *safe, economical* and *speedy* delivery to the next job without injury to either the load or the highway. It can carry enormous weights because it is reinforced at every point to insure *maximum strength.*

What type of trailer do you need? Let us design it for you.

ROGERS BROTHERS CORPORATION
ALBION, PENNSYLVANIA

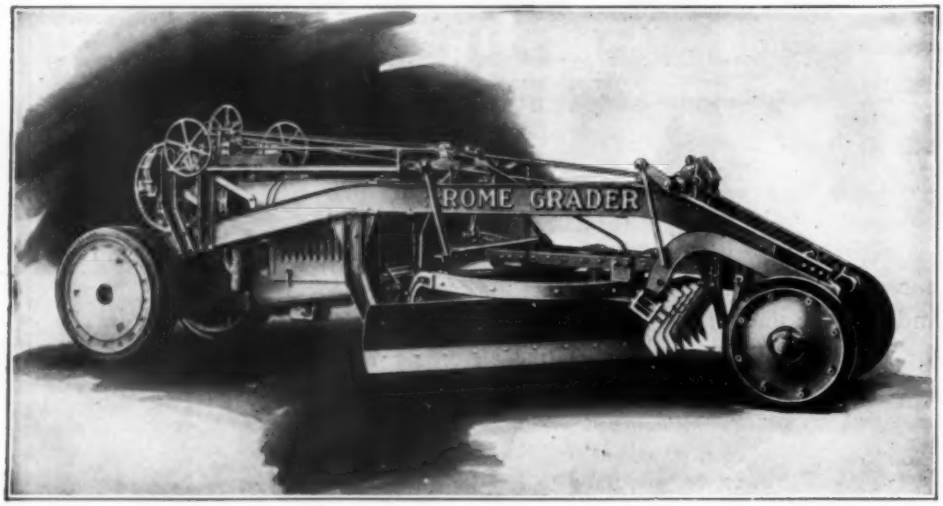


thieves took some of the good bags, others became torn, while a longer time was required to handle cloth bags than paper."

Through the cooperation of the Bates Valve Bag Co., Mr. Johnson is now baling up the empty paper bags and selling them to a paper-stock company for a price of approximately $20 per ton. This is almost one cent apiece. The man who operates the cement mixer also bales the paper bags. As he empties a bag into the mixer, the paper container is thrown aside. During a few spare moments, he gathers these up, piles them on a Handy sack baler, as many as he can press into one bundle and quickly ties them up in packages and places them in a pile ready for hauling off to the paper-stock dealer. The baler used at this job is for the baling of empty cloth sacks, but it is so adaptable to paper that it serves admirably for that purpose. Three stout cords are first laid across the baler table, empty bags are laid on it, an iron bar is laid horizontally through the center and clamped at both ends, holding the pile secure, while the two sides are folded up by a foot pedal and held in position until the three cords are tied across the top. The table sides are then released, the bar withdrawn and the bundle lifted off to a pile.

A General Utility Motor Grader

COMBINING the special as well as the patented features of the regular Rome line of high lift graders, together with the McCormick-Deering tractor, the Locomotive Department of the Rome Manufacturing Co., Rome, N. Y., has developed a new machine that is first a grader and then motor driven.



The New Rome Motor Grader with McCormick-Deering Tractor

The field of the one-man grader is broadening out as road builders, contractors, state, county, town and city officials find greater uses for a machine of this type. The new unit has been especially developed for use, not only as a maintainer, but also for a variety of real road building operations. It is durable and dependable and proving its ability to handle the hardest jobs.

Road Show Notes

The Armco Culvert Manufacturers Assn., Middletown, Ohio, will exhibit a corrugated culvert of Armco iron with a paved invert, also newly perfected fittings for culvert and drainage pipe, an animated display showing the operation of perforated iron pipe and a model showing safe street intersection drainage by the use of half-circle culverts. The exhibit at Space EH-41, is in charge of Anton S. Rosing, Publicity Manager.

The Blaw-Knox Co., Pittsburgh, Pa., will exhibit a 51-ton hinged-leg portable bin equipped with double-weighing batcher, a combination of the volume and weight method plus an auxiliary dial; a 100-ton portable pedestal type assembled bin, completely equipped with the inundation system for road construction; a complete set-up of improved road forms; a set-up of steel forms for street, curb and sidewalk construction; a new dragline bucket; an improved ball-bearing clamshell bucket; a comparison of the self-cleaning and non-self-cleaning principle in bin design and construction; truck turntables; an all-steel batch box; and a calcium chloride machine. The exhibit will be found in Booth AA-18.

The Bucyrus-Erie Co., South Milwaukee, Wis., and Erie, Pa., will exhibit four machines, as follows: A D-2 diesel shovel, a B-2 steam shovel, a Gas+Air shovel, and a combination crane and dragline with straight gasoline power. The exhibit will be in charge of J. A. Garber.

The Climax Engineering Co., Clinton, Iowa, will exhibit an 85-horsepower engine especially adapted for sand pump drive, a Model-KU 4-cylinder engine, connected by a flexible coupling to a Dayton-Dowd 6-inch water pump, and also several other engines complete with equipment. The exhibit will be found in Space AA-37 in charge of Lorimer Dunlevy, Sales manager.

The Continental Motors Corporation, Detroit, Mich., will exhibit the new "A" series motor as well as several new engines in its complete industrial series with a power range from 5 to 96 horsepower. The exhibit will be found at Booths EH-93 and EH-105 in charge of L. J. Kanitz, Industrial Manager, with A. R. Long, S. F. Evelyn, A. R. Smith, A. D. Chandler, S. Nixon, A. M. Sampson and C. R. Wassell assisting.

The Galion Iron Works and Manufacturing Co., Galion, Ohio, will exhibit a full line of modern road rollers, road graders and other road equipment. Several new and interesting developments in the Galion line will be on exhibition for the first time.

The Heil Co., Milwaukee, Wis., will exhibit several models of Heil hydro-hoists which have now been sold for over a year under a two-year guarantee. Steel dump bodies, the new mechanical hoist, underbody hand hoist dump units and the Gettelman high-speed snow plow will also be exhibited. The exhibit will be in charge of E. C. Gilmore, Sales Manager, and Howard A. Winton, General Branch Manager.

Adding another "peak" to the Rockies with

UNION Pile Hammers

Another tough job well handled by UNION:—

"The foundation work (on the new 17-story Mountain States Tel. and Tel. Bldg. in Denver) has been a tough job, as the piling had to be driven in very hard, dry, coarse gravel, with numerous boulders and some hard shale rock. The piling was driven 24 feet into the ground, necessitating the driving of 1300 piles, equivalent to six miles of penetration.

"This work was done with two No. 2 Union Pile Hammers at a steam pressure of 100 to 120 pounds, averaging 125 to 140 blows per minute."

—Thus UNION has done its able part in adding still another "peak" to the "Rockies."

The picture at the left shows one of two Union Hammers which drove 1300 steel sheet piles on the foundation work for this great building going up in Denver. Note what is said about the hard driving through coarse gravel, boulders and hard shale rock.

Union Hammers are a conspicuous success wherever used. You can speed up your pile driving, pile pulling jobs with them.

Nine sizes to select from. Write for "Contractors' Bulletin 63."

UNION-PILE-HAMMERS DRIVE AND PULL

UNION IRON WORKS

Builders of Double Acting Pile Hammers Since 1906

Lackawanna Siding, Hoboken, N. J.

The Roderick Lean Co., Mansfield, Ohio., will exhibit the "Ground Hog" revolving scraper at Space NEH-16.

The Koehring Co., Milwaukee, Wis., will exhibit its 27-E paver, No. 501 shovel, 10-S Dandie mixer and a subgrade planer in Space No. 48 in the West Wing of the Auditorium.

T. L. Smith Co., 1030 - 32nd Street, Milwaukee, Wis., will exhibit the new Smith 27-E paver and a Model 7-S mounted on crosswise trucks.

The Sullivan Machinery Co., Chicago, Ill., will have, as usual, a typical Sullivan operating exhibit, including a WL-22 semi-portable direct-motor-driven compressor, which will be used to operate concrete breakers, clay spaders and several types of new Rotator hammer drills, the Turbinair portable hoist and the drill steel furnace operated by gas, and the all-hammer portable drill sharpener. In addition, a Sullivan scraper hoist of 25 horsepower will be shown in operation as well as two sizes of portable air compressors. The exhibit will be found at Booth WW-40 in the West Annex in charge of Ralph T. Stone, Manager of the Sullivan office at Cleveland.

The Universal Crane Co., Cleveland, Ohio, is to exhibit two cranes, one with the motor truck crawler attachment and the other with a 52-foot boom. The boom is the longest standard boom built for truck crane use. It is made up of a Universal standard 28-foot boom with an 8-foot base and a 16-foot head extension. This exhibit will be found in Space AA-10 on the arena floor of the Main Auditorium with F. A. Peck, Vice-president of the Universal Crane Co., in charge.

The White Co., Cleveland, Ohio, will exhibit three different models of White dump trucks, all particularly designed for highway construction and maintenance work. These include a heavy-duty dump truck chassis, a 2½-ton, 2-batch dump truck, and a 1-ton dump truck with hydraulic underbody hoist. This exhibit will be found at Space WW-6 in the Auditorium Annex, and will be in charge of L. G. Avery, Sales Promotion Manager.

The G. H. Williams Co., Erie, Pa., is to show a new dragline bucket that has a rigid double arch to overcome one of the most stubborn obstacles to successful dragline bucket operation. This exhibit will be found at Booths EH-49-53 in charge of C. F. Weiblen, Manager of the Cleveland Branch of the G. H. Williams Co.

The American Institute of Steel Construction, 285 Madison Avenue, New York, announces that the expansion of the market for structural steel through advertising, better merchandising, development of new ideas and the application of technical research will be the theme of numerous addresses to be delivered in the course of a nation-wide speaking tour by Charles F. Abbott and Lee H. Miller, Executive Director and Chief Engineer, respectively, of the Institute. The tour started with a meeting of local fabricators in Philadelphia on December 20. The itinerary includes Boston, Mass., Syracuse, N. Y., Birmingham, Ala., San Antonio, Texas, Tucson and Phoenix, Ariz., Los Angeles, Del Monte and San Francisco, Calif., Portland, Ore., Seattle and Tacoma, Wash., Denver, Colo. and Kansas City, Mo.

The W. B. Louer Co., distributor of construction equipment, has announced the removal of its offices to larger quarters at 431-35 So. Jefferson Street, Chicago, Ill., where it will have greater facilities for rendering service to its customers.

The Clyde Iron Works Sales Co., Duluth, Minn., has announced the appointment of the following equipment distributors for the sale of Clyde hoists and derricks: Concrete Machinery and Supply Co., Los Angeles, Calif.; Choctaw Culvert & Machinery Co., Memphis, Tenn.; J. W. Bartholow Co., Dallas, Texas; Hunter Machinery Co., Detroit, Mich.; and Northwest Equipment Co., Inc., Butte, Mont.

Construction Industry News

The Bucyrus-Erie merger of the Bucyrus Co. and the Erie Steam Shovel Co. has been announced as becoming effective on January 1, 1928. The offices of the company are at South Milwaukee, Wis. and Erie, Pa. The manufacturing plants are located at South Milwaukee, Erie, and Evansville, Ind. The following officers have been elected: W. W. Coleman, President; E. K. Swigart, Senior Vice-president; F. B. McBrier, A. C. Vicary, D. P. Eells and W. M. Bager, Vice-presidents; G. A. Morrison, Vice-president and Treasurer, and J. G. Miller, Secretary. Mr. Coleman is Chairman of the Board of Directors. Mr. Vicary, formerly Vice-president of the Erie Steam Shovel Co., is now in charge of the consolidated domestic sales organization, and Mr. Eells, formerly in charge of the foreign business of Bucyrus, is directing the foreign sales Dept.

The Byers Machine Co., Ravenna, Ohio, has announced the purchase of the Massillon Power Shovel Co., Massillon, Ohio. The Byers Co. has bought the Massillon stock and is taking over the entire responsibility of distribution and sales of Massillon shovels along with the Byers Bear-Cat line. This enables the Byers organization to sell a complete line of shovels and cranes from ½-yard to 1¼-yard capacities, including the ½- and ⅝-yard Byers Bear Cat, and the Massillon-35 gas shovel of 1- and 1¼-yards capacities. The present manufacturing plants of both companies will be continued, Massillon shovels being manufactured as before at Massillon, Ohio.

L. S. Shaffer, President and General Manager of The Byers Machine Co., will continue the management of the enlarged Byers Machine Co., and C. H. Collier, Director of Sales of The Byers Machine Co., will be in charge of sales for both plants.

Insley Manufacturing Co., Indianapolis, Ind., has announced that W. W. Engelking, formerly of the Clyde Iron Works Sales Co., has joined the Insley sales forces and will specialize in engineering sales in connection with slackline installations, concrete chuting plants and will also devote a considerable portion of his time to excavator sales.

The Lidgerwood Manufacturing Co. has announced a change of address for its general offices from 96 Liberty Street, New York, to 775 Lidgerwood Avenue, Elizabeth, N. J.

The Link-Belt Co., 910 South Michigan Avenue, Chicago, Ill., has announced the appointment of four Vice-Presidents, as follows: George P. Torrence, with headquarters at Indianapolis in charge of Indianapolis operations and sales of Indianapolis plant products; George L. Morehead, Philadelphia, in charge of Eastern operations and sales; Frank B. Caldwell in charge of the Chicago plant and sales offices tributary thereto; W. C. Carter, in general charge of production at all plants with headquarters at the general office of the company. In addition to these Vice-presidents, the officers of the Link-Belt Co. are: Charles Piez, Chairman; Alfred Kauffmann, President, both of Chicago; Humphrey J. Kiely, Vice-president, New York and Richard W. Yerkes, Secretary and Treasurer, Chicago.

The T. L. Smith Co., Milwaukee, Wis., manufacturers of concrete mixers and pavers, has announced the appointment of James H. Smith as Field Sales Representative to agents. Mr. Smith was formerly located in the south for the Novo Engine Co. and will now have his headquarters in Milwaukee.

The Mundy Sales Corporation, 30 Church Street, New York, has announced the appointment of the Prues Equipment Co., Cincinnati, Ohio, as exclusive distributors for the Mundy line of hoisting equipment and the Dobbie line of derricks.

Boost your profits with a "pair of jacks"

Contractors *increase business and earnings* through this new ARMCO method of culvert installation.

From Nebraska, Oklahoma, Texas, New York, and from New England, come reports of quick and satisfactory culvert installations by the Armco jacking method. On each job the officials in charge saved time and money and increased the safety of their work. On each, there was a handsome profit for the contractor.

Opportunities like these exist in every state. Wherever openings are required under existing embankments—for new culverts, for conduits, for undercrossings, for cattle passes—there is also a profit awaiting the live contractor.

Literally, in addition to your ordinary tools, all the equipment needed is a pair of sturdy jacks. Small investment, small crew—quick turn-over, satisfactory return. If you are interested in the Armco jacking method as a profitable side line or as an exclusive specialty, write us for practical working data not available from any other source.

[SEE US AT THE ROAD SHOW—BOOTH EH-41]

Forty manufacturing plants throughout the United States and Canada assure you immediate service on drainage requirements, no matter where you may be.

ARMCO CULVERT MANUFACTURERS' ASSOCIATION
MIDDLETOWN, OHIO

ARMCO CULVERTS

Predominant in use—because predominant in quality

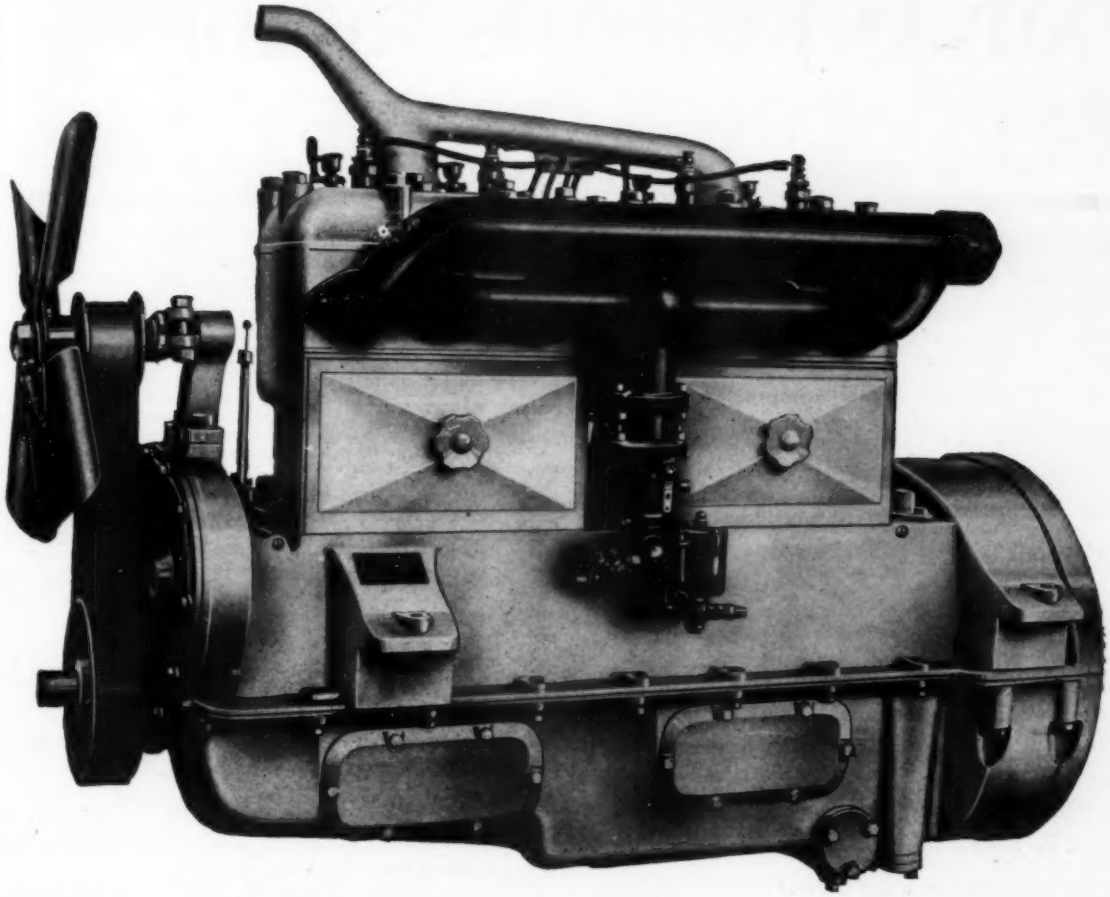
© 1928, Armco Culverts Mfrs' Assn., Middletown, Ohio

Pathos in Construction

Published through the courtesy of the New York World.

"HI, OVER THERE! WAIT A MINUTE. I DROPPED MY DOLL DOWN THAT HOLE."

HUSKY POWERFUL ECONOMICAL



What If The Heart Stops?

See our Power Unit exhibit at the 1928 Road Show. Booth AA-37 Arena, Exhibition Hall, Cleveland, Ohio, January 9-13 inclusive.

The engine you use must be husky for continuous service—must be built of the right materials for eliminating costly repairs—must be designed correctly for generating ample power—and must be capable of eliminating the lost time accruing from frequent delays. Climax Power units are *husky, powerful* and *economical.*

CLIMAX ENGINEERING CO.
71 West 18th Avenue · · Clinton, Iowa

CLIMAX

Trustworthy Engines

Where the Climax "Heart" Beats Strongest

On Shovels
On Other Excavating Machinery
On Road Rollers
On Tractors
On Farm Machinery
On Industrial Locomotives
On Locomotive Cranes
On Portable Saw Mills
On Compressors
On Pumps
On Generators
On Stone Crushers
On Hoists

ADVANTAGEOUS READING FOR CONTRACTORS

These especially selected catalogs and pamphlets of value to contractors are for free distribution.

You will find it worth while to check these lists each month and write for the catalogs you need.

A FAST-MOVING CRANE FOR CONTRACTORS
Universal motor-truck-mounted cranes which are now built with a crawler attachment that can be quickly mounted or demounted, depending on the character of the soil where the crane is operating, are completely described in Bulletin 644 which may be secured from the Universal Crane Co., 927 Swetland Building, Cleveland, Ohio.

CONCRETE—ITS MANUFACTURE AND USE
This is the title of a 204-page illustrated bound book of pocket size issued by the Koehring Co., Milwaukee, Wis., which is replete with tables and diagrams covering everything in concrete construction from materials, forms, mixers and water for all kinds of concrete construction.

SELF-PROPELLED PORTABLE STONE CRUSHERS
Bulletin No. 127, issued by the Acme Road Machinery Co., Inc., Frankfort, N. Y., completely describes this company's self-propelled portable stone crushers which are moved to the job by the same power plant which operates the unit.

CONCRETE MIXERS AND HOISTS FOR EVERY JOB
The American Cement Machine Co., Inc., Dept. 237, Keokuk, Iowa, will be pleased to send to interested contractors a copy of its catalog, showing the latest improvements, labor-saving attachments, new models and the complete line of Boss mixers, drum mixers, heavy-duty tilters, pavers and hoists for every use.

A COMPLETE WOODWORKING SHOP ON THE JOB
Complete information and prices on American woodworkers which give a complete woodworking shop on the job, thus saving costly delays, as well as data on the complete line of American saw rigs and hoists, may be secured without obligation from the American Saw Mill Machinery Co., 171 Main Street, Hackettstown, N. J.

TRACTORS FOR HEAVY-DUTY WORK
Caterpillar tractors, which are powerful ground grippers, making possible the use of heavier graders, bigger wagons and larger scrapers on earth moving jobs, are described in literature which may be secured free on request from the Caterpillar Tractor Co., San Leandro, Calif.

AIR-COOLED ENGINES FOR CONSTRUCTION
A new air-cooled engine that is simple, compact, and delivers more power per pound weight than any other complete engine, is described in literature of the New-Way Motor Co., Lansing, Mich., which is free on request.

A ROLLER WITH DUPLEX WORM DRIVE
A new 10-ton, 4-cylinder motor roller with modern stream-line design and duplex worm gear drive, the "Autocrat," is completely described and illustrated in a circular of The Austin-Western Road Machinery Co., 400 N. Michigan Avenue, Chicago, Ill.

PORTABLE AIR COMPRESSORS
The portable gasoline-engine-driven air compressors of the Gardner-Denver Co., Denver, Colo., are designed to give the maximum power available to meet the most difficult requiremnts of construction work, and are described in Bulletin No. 200-A, which is free on request.

SHOVEL, CRANE, DRAGLINE AND BACK DIGGER
A most thorough bulletin has been issued by The Thew Shovel Co. Lorain, Ohio, which describes the Lorain 75 shovel, crane, dragline and back digger, that is a 1¼-yard machine yet occupies only the space of the average ¾-yard crane or shovel.

COMPRESSORS FOR ALL KINDS OF PNEUMATIC TOOLS
The Cement-Gun Co., Inc., Allentown, Pa., will be pleased to send full information on the Traylor portable horizontal type compressor which is double acting, sturdy and reliable, with long life and low upkeep for operating rock drills, chipping hammers or other pneumatic tools.

A SIMPLE 3-SPEED HOIST
The Mundy patented 3-speed hoist which is virtually three hoists with three different hoisting speeds, built into one single compact unit, and yet is simple to operate, is described in literature which will be mailed on request without obligation by the Mundy Sales Corporation, 30 Church Street, New York.

A PORTABLE HOIST
The Porta Hoist of either the single or double-drum type, which does its work rapidly and then moves itself and other equipment under its own power to the next job, is manufactured by Pioneer Tractors, Inc., Winona, Minn., which will be glad to send descriptive bulletins on request.

A TESTING SERVICE FOR CONTRACTORS
Bulletin 26, issued by the Pittsburgh Testing Laboratory, Pittsburgh, Pa., tells all about the Pittsburgh Testing Laboratory test and analysis service, which gives scientifically exact information on concrete and other contracting work.

A NEW SAND AND GRAVEL WASHER
The Smith Engineering Works, 1820 Holton Street, Milwaukee, Wis., will be glad to send without cost or obligation a copy of its Bulletin A. W. 21, which tells all about the details of the Telsmith-Ajax all-metal washer for sand and gravel.

ASPHALTS FOR EVERY PURPOSE
Complete information regarding asphalts of all types for every purpose will be sent to interested contractors free on request by the Standard Oil Co. of Indiana, 910 South Michigan Avenue, Chicago, Ill.

A PAVER CATALOG FOR CONTRACTORS
The 1927 Paver Catalogue of the Chain Belt Co., 766 Park Street, Milwaukee, Wis., is easy to read and tells all the details regarding Rex pavers which pour more yards per day at a lower cost per yard and live through more seasons for a lower cost per year.

PORTABLE CONVEYOR
The Chicago Automatic Conveyor Co., 1849 South 55th Street, Cicero, Ill., will be pleased to send complete information, and prices to contractors interested in the Automatic portable conveyor, which has a non-clogging receiving end and can be used for every conveying purpose.

HUSKY POWER UNITS
Climax engines, which are uncommonly powerful and furnish a substantial, economical source of power for shovels and other excavating machinery, as well as road rollers, tractors, compressors, pumps, generators, stone crushers, hoists and other contracting equipment, are decribed in literature which may be secured from the Climax Engineering Co., 71 West 18th Avenue, Clinton, Iowa.

CONCRETE FINISHERS AND SURFACERS
Interesting information concerning the Berg concrete finisher and surfacer for removing fins, board or form marks and all irregularities from concrete construction, as well as for cutting brick walls preparatory to stucco application and grinding paint from brick, will be mailed upon request by the Concrete Surfacing Machinery Co., 4669-71 Spring Grove Avenue, Dept. F, Cincinnati, Ohio.

STRONG WHEELBARROWS
The Sterling Wheelbarrow Co., Milwaukee, Wis., manufacturers of Sterling wheelbarrows, which have a scientifically designed V-shape front brace which holds the tray in shape and strengthens the frame, will be pleased to send complete data on these wheelbarrows on request.

ENGINES—SAWS—PUMPERS
The complete catalog of the Witte Engine Works, 3019 Witte Building, Kansas City, Mo., describes this company's line of pumpers, log saws and all-fuel engines in capacities from 1½ to 30-horsepower.

LIGHTS FOR NIGHT CONSTRUCTION
Booklet 223, issued by the Alexander Milburn Co., Baltimore, Md., describes the complete line of Milburn portable lights, which use any kind of carbide at a cost of three cents per hour for 8,000 candlepower lights.

BLOCKS FOR MANILA OR WIRE ROPE
The Western Block Co., Lockport, N. Y., will be pleased to send to contractors requesting it a copy of Catalog C.E., describing Anvil brand blocks for manila or wire rope made in all standard sizes and styles or furnished to your specifications.

HANDBOOK ON STRUCTURAL WATERPROOFING
The Contract Waterproofing Co., 1956 Railway Exchange Building, St. Louis, Mo., has published a particularly helpful illustrated 95-page catalog setting forth the advantages of Ferro-Tite used in the iron methods of waterproofing and oil proofing of subterra construction and structures. This book may be secured free on request.

ECONOMY IN CHAIN SPROCKETS
A renewable tooth sprocket for chain drives, that can be furnished in any size so that it can be used as a replacement part, and that is made for large chains having a pitch usually greater than 3 inches, is described in free literature of The Union Chain & Mfg. Co., Sandusky, Ohio.

OPEN ROADS AT LOW COST
This is the title of a new snow removal circular which has been issued by the Trackson Co., 519 Clinton Street, Milwaukee, Wis., and will be sent free on request. It points out the economy of the Fordson equipped with Trackson full-crawlers for keeping streets and highways open all winter.

SNOW REMOVAL AT GREAT SAVINGS
A complete catalog, describing the North hydraulic digger that loads 300 to 500 yards of piled snow per day, is substantially built, easily operated, powered by Fordson, equipped with rubber-tired wheels and has no brakes or clutches to get out of order, may be obtained free of charge from the W. M. Blair Mfg. Co., 3673 Michigan Avenue, Chicago, Ill.

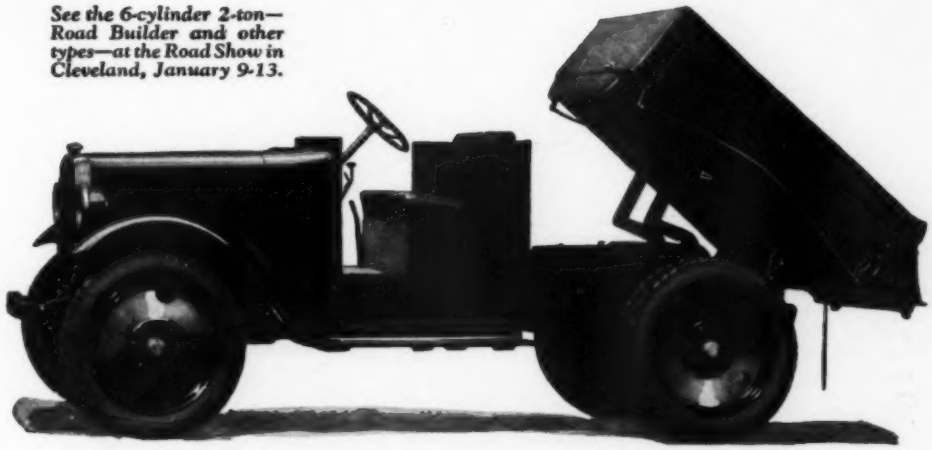
A RECORD OF TRUCK IDLENESS
The Servis Recorder, made by the Service Recorder Co., Hanna Building, Cleveland, Ohio, is a small instrument readily installed on any truck or passenger car which makes a graphic record of the time the truck is in operation and the time it is standing still. This helps municipal officials, business houses and contractors to tell just exactly what value they are getting out of their investment in trucks and passenger cars. Complete information regarding the Servis Recorder may be secured from the manufacturer free on request.

DEPENDABLE, LOW-COST POWER
LeRoi engines, which give dependable, low-cost power on all types of contracting jobs on mixers, saw-rigs and other kinds of construction equipment, are described in literature which may be secured on request from the LeRoi Co., Milwaukee, Wis.

PORTABLE OIL BURNERS
Bulletin C-6, issued by Littleford Brothers, 485 East Pearl Street, Cincinnati, Ohio, gives full details regarding the Littleford portable oil burners for supplying heat for tar and asphalt melting kettles, thawing and drying holes in roads before patching, thawing frozen piles of sand, gravel, stone, etc., heating mortar boxes in cold weather, drying concrete for waterproofing or heating concrete in mixers.

See the NEW 6 CYLINDER 2-TON ROAD BUILDER

See the 6-cylinder 2-ton—Road Builder and other types—at the Road Show in Cleveland, January 9-13.



Power and speed made usable to the maximum degree .... Ruggedness and dependability that mean staying on the job .... Price so low that equipment capital is released for other work .... That is the new Graham Brothers Road Builder.

Six cylinder engine .... 4-speed transmission (a low low for exceptional pulling) .... 4-wheel brakes (Lockheed Hydraulic) .... a chassis designed especially for the demands of 2-Ton dump truck work.

Your local Dodge Brothers dealer will gladly show you this money maker.

$1645
(CHASSIS F. O. B. DETROIT)

GRAHAM BROTHERS TRUCKS

Sold and Serviced by Dodge Brothers Dealers Everywhere

Built by Truck Division of Dodge Brothers, Inc.

DEPENDABLE POWER FOR EVERY PURPOSE
Red Seal Continental Motors for heavy duty work on contractors' equipment where their long life, economy and rugged construction provide dependable power for every purpose, are manufactured by the Continental Motors Corporation, Industrial Equipment Division, Muskegon, Mich., which will send complete descriptions on request.

FLAKE GRAPHITE FOR LUBRICATION
Circular 148-C, issued by the Joseph Dixon Crucible Co., Jersey City, N. J., tells in detail all about Dixon's flake graphite, which is the ideal natural lubricant for cylinders and bearings, coating gaskets, etc., in either the No. 1 coarse flake or No. 2 powdered flake form.

TRUCKS WITH SERVICE
Completeness and accessibility of service facilities add to the value of a contractor's investment in Graham Brothers trucks. Literature describing these trucks may be secured without obligation from Graham Brothers, Detroit, Mich., by contractors interested in dependable haulage units.

NEW CATALOGS ON ROAD BUILDING EQUIPMENT
The Heltzel Steel Form and Iron Co., Warren, Ohio, will be pleased to send copies of its new catalogs, "Modern Road Building Equipment," "Modern Street Building Equipment," and "Modern Material Handling Equipment" on request to contractors interested in this company's new road building equipment.

STEEL MAST HOISTS THAT LAST
The Insley Manufacturing Co., Indianapolis, Ind., will gladly explain to interested contractors just why the Insley mast hoist is so generally used on all kinds of concrete placing jobs from one coast to the other.

HEAVY-DUTY TRUCKS FOR CONTRACTORS
Complete information and prices on Mack trucks for all types of construction hauling may be secured free on request from Mack Trucks, Inc., 25 Broadway, New York, manufacturers of dependable haulage equipment.

DRIVING PILES UNDER WATER
Many interesting pictures of submarine pile driving, as well as one hundred pictures of all kinds of pile driving from the heaviest to the lightest, will be found in the new catalog of the McKiernan-Terry Drill Co., 19 Park Row, New York, which will be sent to contractors requesting it on their own letterheads.

A SPECIALLY DESIGNED GRADING ROLLER
A special grading roller that is capable of performing all of the functions of a standard grader as well as rolling and scarifying, that has the weight and stability of the largest power graders and is narrow enough to permit its use between forms of strip-built concrete roads, is described in literature of The Buffalo-Springfield Roller Co., Springfield, Ohio.

POWER SHOVELS AND INTERCHANGEABLE UNITS
Bulletin No. 6 of the Universal Power Shovel Co., Detroit, Mich, is an engineering, sales and service manual that describes and illustrates the Wilford line of power shovels and interchangeable units, which consists of shovel, trench hoe, clamshell, crane, dragline and backfiller.

A BOTTOM DUMP TRAILER
A 5-ton, all-steel, 4-wheeled, bottom-dump trailer, the MD-7, for use with heavy-duty tractors, which has a low loading height of 64½ inches, a short turning radius, a water level capacity of 3 yards and will carry a full rounded load of from 4 to 4½ cubic yards, is described in free literature of The Miami Trailer-Scraper Co., Troy, Ohio.

A MOTOR-DRIVEN ARC WELDER
A direct current arc welding machine operated by a 3-phase alternating current motor, at either 220 or 440 volts, both the welding generator and motor being mounted on the same shaft making a 2-bearing unit, is described in the literature of the Fusion Welding Corporation, 103rd Street and Torrence Avenue, Chicago, Ill.

PICK YOUR BUCKET FROM THIS CATALOG
The G. H. Williams Co., Erie, Pa., has issued a new catalog replete with illustrations and containing a detailed statement of the kind of service for which each of its 11 types of buckets is best suited. This catalog may be secured by any interested contractor direct from the manufacturer.

AN EFFICIENT PORTABLE PUMP
Bulletin 56 issued by the American Steam Pump Co., Battle Creek, Mich., describes the Barton portable pump which attaches to the front of any car or truck, being run by the car engine, and is made in sizes from 60 to 900 gallons per minute with automatic primer.

WHEELBARROWS THAT SPEED UP WORK
Lansing wheelbarrows which are built for hard work, are strong and sturdy and will speed up work are described in a free catalog which may be secured on request from the Lansing Co., Lansing, Mich.

A WHEELBARROW CATALOG
The Toledo Wheelbarrow Co., 69 E. Wacker Drive, Chicago, Ill., will be pleased to send contractors a copy of its illustrated free catalog describing Bull Frog wheelbarrows, carts, and scrapers for every use.

AN ELECTRIC PLANT FOR FLOODLIGHTING
Bulletin PEP-1, describing the PowermakeR electric plant for flood lighting on construction jobs, will be of interest to contractors undertaking night work and may be secured free on request from the Cook Motor Co., Delaware, Ohio.

DISC-FEED LOADERS
Complete information and prices on Barber-Greene "25" and "42" disc-feed loaders which can be set to skim the ground, missing the dirt at the bottom of the pile and leaving no clean-up for the shovel, may be secured from the Barber-Greene Co., 485 W. Park Avenue, Aurora, Ill.

PUMPS FOR HEAVY-DUTY SERVICE
The Humphryes Manufacturing Co., Mansfield, Ohio, will be pleased to send complete information and prices to contractors interested in its line of high capacity diaphragm pumps, lift and force trench pumps and direct-connected centrifugals.

SHOVELS BUILT FOR PERFORMANCE
Catalog No. 895, issued by the Link-Belt Co., 300 West Pershing Road, Chicago, Ill., tells all about Link-Belt shovels and tells how they have earned nation-wide acceptance for material handling because of their high performance records.

A DRUM-TYPE CAR PULLER
A drum-type car puller that is simple, effective and economical, that will pay for itself in a very short time, and is applicable to every type industry, is described in free literature of the Clyde Iron Works Sales Co., Duluth, Minn.

MAGNETOS FOR POWER AND ECONOMY
Eisemann magnetos for economical operation and that cause no expensive delays or shut-downs are described in literature of the Eisemann Magneto Corporation, 165 Broadway, New York, which is free on request.

PURE WATER SUPPLIES
Technical publication No. 55 of Wallace & Tiernan Co., Inc., Newark, N. J., describes and illustrates the W & T Chlorometer that is intended largely for small water supplies and for indoor swimming pools, and is absolutely automatic in operation, requiring no attention other than replenishing the sterilizing solution.

FOUR-CYLINDER MOTOR ROLLERS
A free catalog giving full mechanical details on Huber 4-cylinder motor rollers which are made in four sizes, 5, 7, 10 and 12 tons, and with easy single lever control, may be secured by writing to the Huber Manufacturing Co., 308 E. Center Street, Marion, Ohio.

WIRE BAR TIES
Bates wire bar ties, manufactured by the Bates Valve Bag Corporation, 35 East Wacker Drive, Chicago, Ill., are described in literature which may be secured from this company and which tells how they are used for tying reinforcing bars by simply making two or three turns with a tying tool.

A CONCRETE CART WITH RENEWABLE BUSHINGS
Complete information and prices on the "General" concrete cart which has renewable bushings on the axle to take the wear so that the axles never need to be replaced, may be secured without obligation by writing to the General Wheelbarrow Co., 3140 East 65th Street, Cleveland, Ohio.

OIL BURNING TAR KETTLES AND TORCHES
Circular No. 12 of the Chausse Oil Burner Co., 1227 W. Beardsley Avenue, Elkhart, Ind., describes and illustrates oil burning tar kettles, kerosene torches and complete asphalt plants, and will be sent free on request.

RAPID AND POSITIVE COLUMN CLAMPS
The W. A. K. column clamp that is rapid, positive, can't slip and draws the band iron taut, is described in literature of W. A. Kuhlman & Co., Toledo, Ohio, which will be sent free to interested contractors and engineers.

OPEN-TRUSS STEEL JOISTS
Descriptions of the open-truss type steel joists and advantages of the design, wood floor and concrete floor construction, properties, dimensions and typical calculations, and other important details are contained in the Data Book of the Truscon Steel Co., Youngstown, Ohio.

A TRIPLE-ACTION ROAD BUILDER
A triple-action road builder, the Greyhound, that scarifies, grades and rolls at one time, one operation and by one man, is described and illustrated in free literature which The Banting Manufacturing Co., Toledo, Ohio, will be glad to send on request.

PNEUMATIC CONCRETE PLACERS
The Ransome Concrete Machinery Co., Dunellen, N. J., will be pleased to send complete information on its concrete placing equipment for lining tunnels, with data regarding various large jobs on which it has been successfully used, to contractors interested in this type of work.

BRANDED TOOLS AND TIRES ARE NOT STOLEN
Complete information regarding the Everhot branding system for contractors' tools and tires to keep them on the job and minimize theft, may be secured from the Everhot Manufacturing Co., 603 10th Avenue, Maywood, Ill.

A POWERFUL TRACTOR FOR SNOW REMOVAL
The JT Tractor Co., East 179th and St. Clair Avenue, Cleveland, Ohio, will be pleased to send complete information and prices without obligation to contractors interested in the JT tractor, which may be used as a powerful tractor for snow removal in winter and for grading and hauling work during the rest of the year.

TROUBLELESS MIXERS
Catalog No. 526, issued by the T. L. Smith Co., 1030 32nd Street, Milwaukee, Wis., from which a copy can be secured on request, describes the complete line of Smith 2½-S up to 112-S mixers and tells why they are known for their exceptional dependability and freedom from trouble in operation.

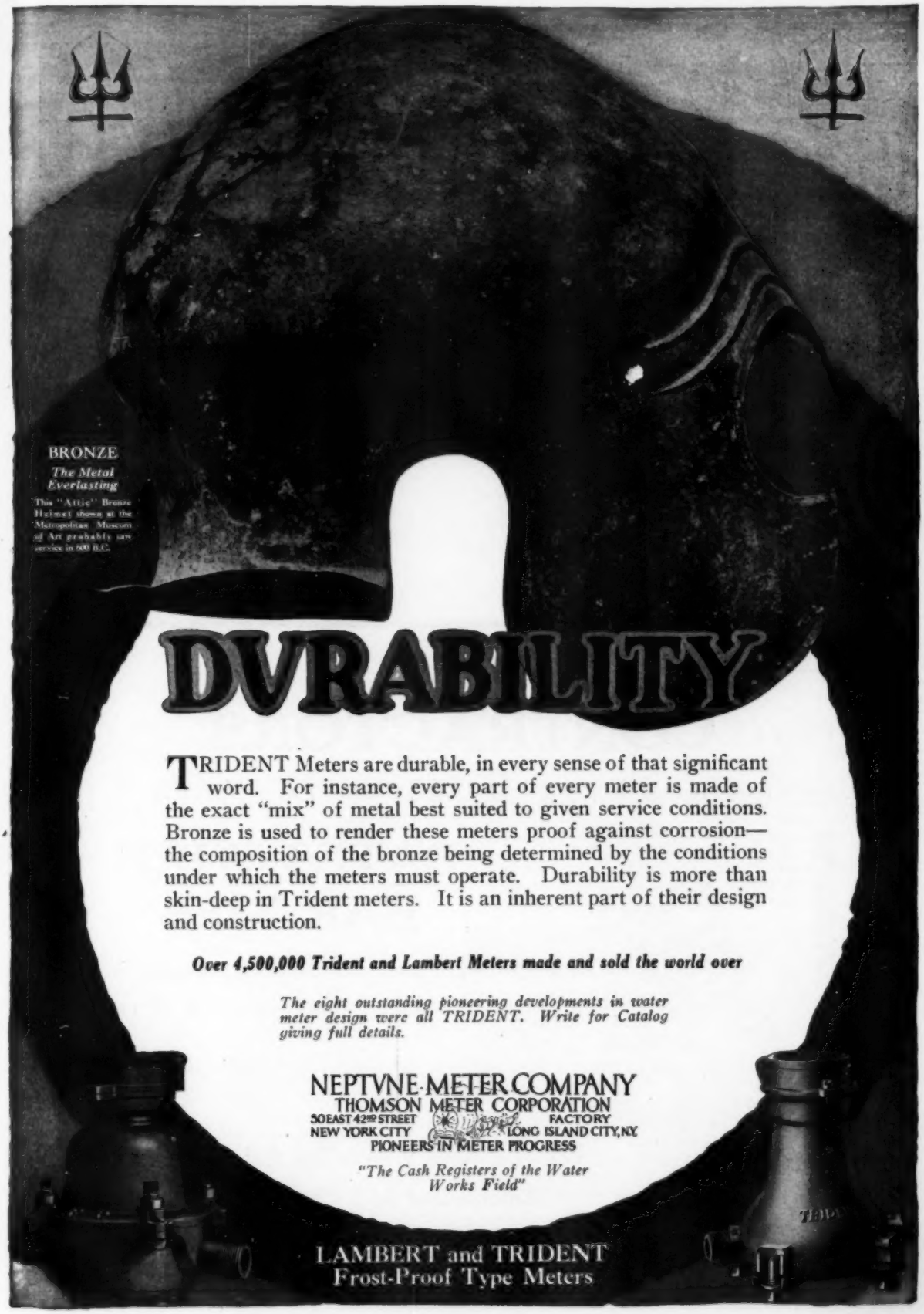
MACHINES FOR SUBGRADING
Carr machines for subgrading, including the Foamgrader for digging form trenches, the Road Rooter, a modern tractor plow, the True Grade scarifier for cutting high places on the hardest subgrades and the new True Grade planer which cuts half of the surface at a time and requires only half the power, are described in literature which may be secured free on request from Ted Carr & Co., 939 West North Avenue, Chicago, Ill.

STURDY DIAPHRAGM PUMPS
Complete details regarding Novo diaphragm pumps with the Tripl-Life Diaphragm and capacities from 50 to 10,000 gallons per hour, will be sent on request by the Novo Engine Co., 216 Porter Street, Lansing, Mich.

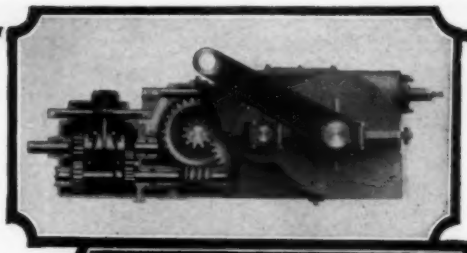
DEPENDABLE SHOVELS
The Erie Steam Shovel Co., Erie, Pa., manufacturers of Erie Gas + Air shovels, will be glad to send complete information and prices on these sturdy, dependable shovels and their records for service and yardage.

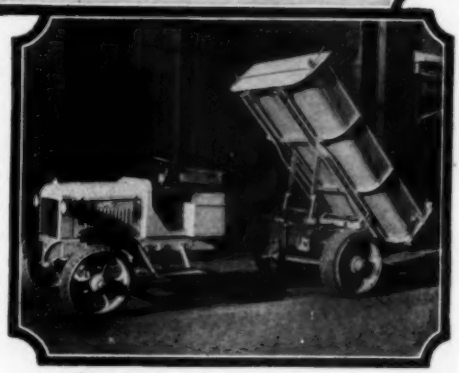
PLASTER MIXERS
The Blystone circular issued by the Blystone Manufacturing Co., 1227 C Street, Cambridge Springs, Pa., describes this company's mixers which mix enough plaster to keep 25 plasterers busy allowing the use of 30 to 40 per cent more sand than when mixed by hand and give a more thorough mix.

SIMPLE AND RUGGED MIXERS
Simplicity of construction and uncommon ruggedness of all parts, high quality and reasonable price, distinguish the mixers of The John Lauson Mfg. Co., 11 Jackson Street, New Holstein, Wis. Literature describing these mixers in detail may be obtained free.


BRONZE
The Metal Everlasting
This "Attic" Bronze Helmet shown at the Metropolitan Museum of Art probably saw service in 600 B.C.
DURABILITY
TRIDENT Meters are durable, in every sense of that significant word. For instance, every part of every meter is made of the exact "mix" of metal best suited to given service conditions. Bronze is used to render these meters proof against corrosion—the composition of the bronze being determined by the conditions under which the meters must operate. Durability is more than skin-deep in Trident meters. It is an inherent part of their design and construction.
Over 4,500,000 Trident and Lambert Meters made and sold the world over
The eight outstanding pioneering developments in water meter design were all TRIDENT. Write for Catalog giving full details.
NEPTUNE METER COMPANY
THOMSON METER CORPORATION
50 EAST 42nd STREET NEW YORK CITY
FACTORY LONG ISLAND CITY, N.Y.
PIONEERS IN METER PROGRESS
"The Cash Registers of the Water Works Field"
LAMBERT and TRIDENT
Frost-Proof Type Meters

Hoist and Body Units That Pay Real Profits





VAN DORN hoist and body units are profit producers because their action is positive and trouble-free because they are built to stand the gaff of hard, continuous service.

Constantly bathed in oil and operating on the worm gear principal the hoist mechanism cannot be surpassed for service. The body itself, while lighter than ordinary truck bodies, has a strength far out of proportion to its weight.

A Van Dorn mechanical hoist plus a Van Dorn body is a combination that means real profits for the operator.

THE VAN DORN IRON WORKS CO.

2685 E. 79th St. ***Truck Division*** **Cleveland, Ohio**

"More Pay Loads—More Profits"

Van Dorn
MASTERCRAFTSMANSHIP IN STEEL

CONTRACTORS

LABORERS x TIME = DOLLARS

Tying Concrete Reinforcing Bars with Wire Tie and Tying Tool

BATES WIRE BAR TIES

Will save you time, labor and dollars.

No skilled labor required to use this equipment.

Two or three turns with tying tool and bars are tied.

Ideal to use in cold weather—men do not have to take off their gloves.

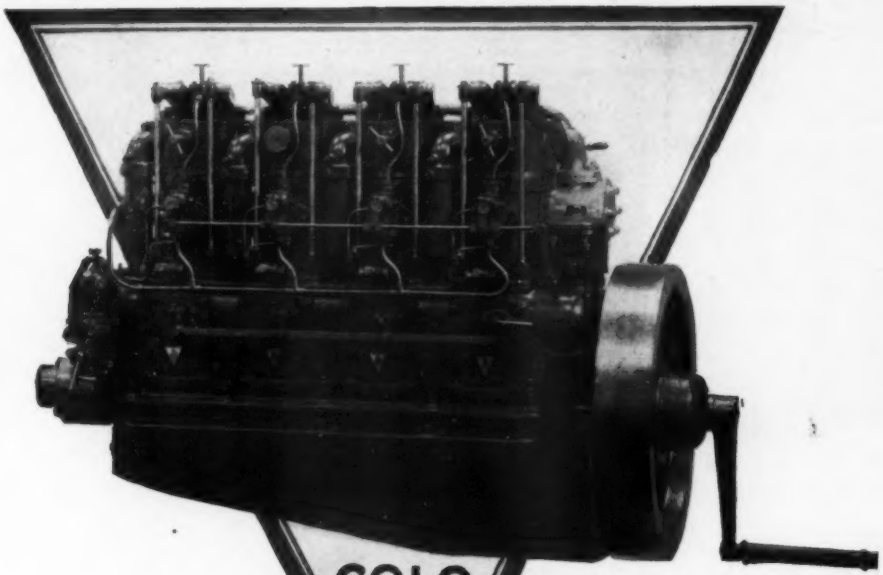
Manufactured by

BATES VALVE BAG CORP.

35 East Wacker Drive **Chicago, Illinois**

Do you mention the CONTRACTORS AND ENGINEERS MONTHLY when writing? Please do.

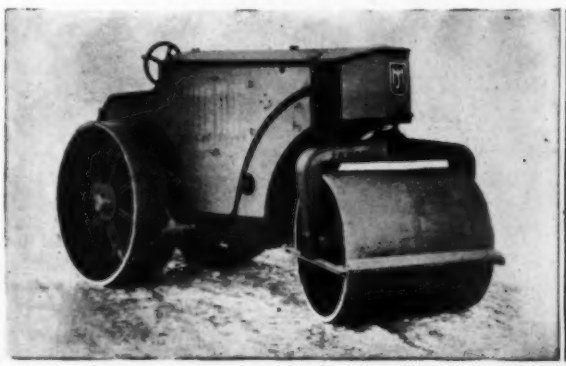
COLO-DIESEL

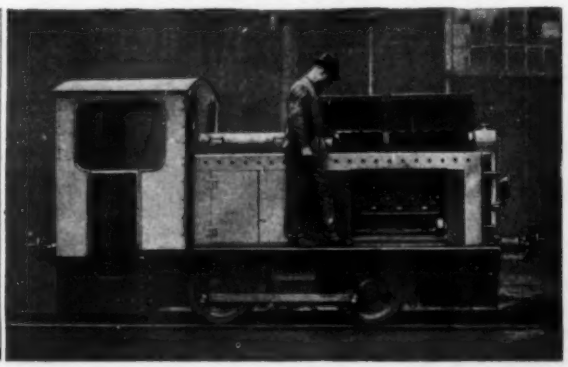


for Mobile Equipment

THE Colo-Diesel is ideal for installation in Shovels, Drag Lines, Tractors, Road Building Machinery, etc. For instance, the four-cylinder engine, including flywheel, silencer and fuel tank, only weighs 1,800 lbs., corresponding to 45 lbs. per b.hp. for the complete installation.

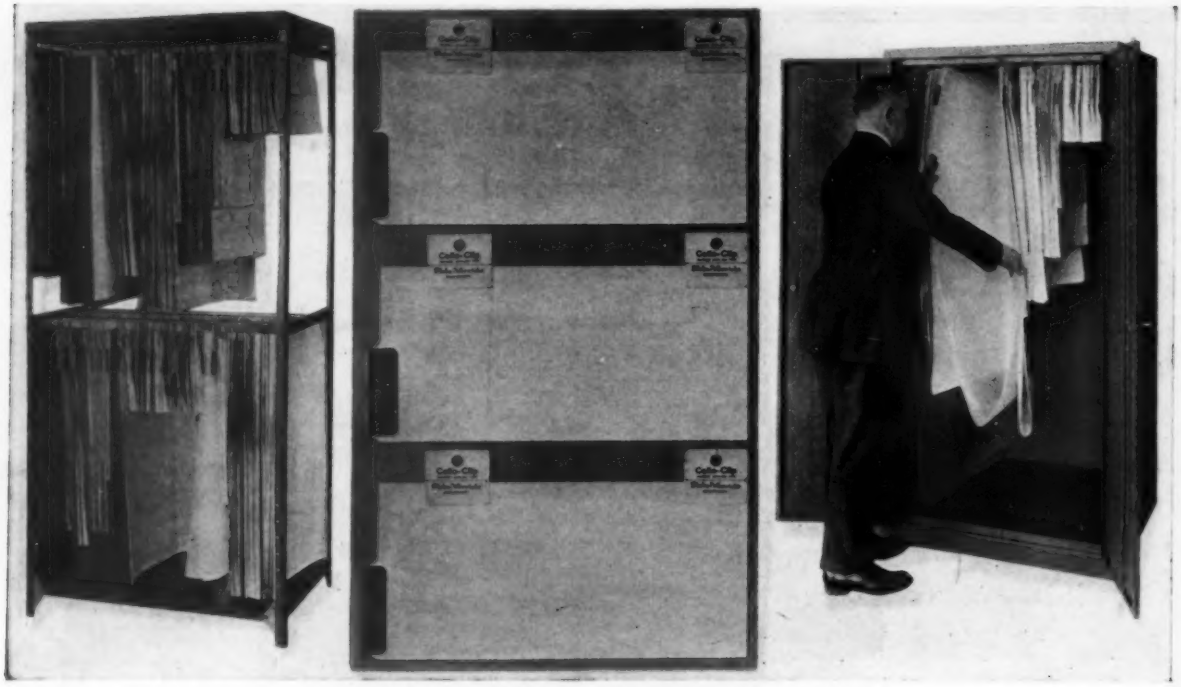
The Colo-Diesel will fit most Mobile Equipment without altering the existing foundations. Cylinder size 5 by 7 inches up to 6 cylinders. Below are shown a 12-ton roadroller and an 8-ton locomotive equipped with 3 and 4 cylinder Colo-Diesel motors as standard powerplant. Colo-Diesel motors will cut down operating expense and increase efficiency of your mobile, portable and stationary equipment.





F. VAN ROSSEN HOOGENDYK **GRAYBAR BUILDING, NEW YORK CITY**

Sole U. S. A. Distributor



The New Globe-Wernicke Blue Print Filing Cabinet and Clips

A Filing System for Drawings, Maps and Plans

FILING systems for drawings, maps and plans make for efficiency in construction and engineering as well as in other fields. The system devised by The Globe-Wernicke Co., Cincinnati, Ohio, has many desirable features for contractors and engineers.

The nucleus of the system is a clip composed of a strip of celluloid enclosed in India rubber adhesive cloth. One end of the clip is attached by adhesion to the drawing. The other end contains a hole and slit that permit suspending the sheet by snapping the clip over horizontal rods. Two or more clips are used per sheet and the sheets are strung on an assembly of polished rods that are mounted in cabinets or in open racks.

Mounted on the assembly of polished rods is a set of six riders made of ply wood. These riders enable the contents of the rack to be shifted laterally, to gain access for the removal of a drawing. The clips also serve as handles to the drawing, and it is not necessary for the hands to come in contact with the sheets when removing or replacing a drawing.

Guide cards are distributed along the rod assembly to produce a visible index. Numerical guides with green and yellow angle tabs are used to form a numerical index, and the location of specific drawings or subdivisions of the file are marked by guide cards with orange angle tabs.

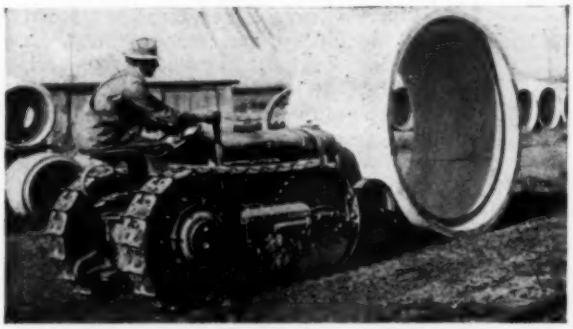
All sheets are visible and equally accessible, regardless of the size of the sheet, and any sheet may be referred to without removal from the file. When the storage is in a vault, the enclosing cabinet may be omitted and the rod assemblies mounted in racks. These racks may be made to suit the dimensions of the vault, and a compact arrangement of high capacity produced without cramping and with equal visibility and accessibility for all drawings.

The 1928 Leipzig Spring Trade Fair

The Leipzig Spring Fair is to be held from March 4 to March 10, 1928, in Leipzig, Germany. It is stated that more than 2,000 buyers and exhibitors from all parts of the United States will take place in this Fair.

A Time and Money Saving Crawler

AN ingenious method has been evolved by the Illinois-Wisconsin Concrete Pipe & Tile Co., Beloit, Wis., for moving concrete tile to position, saving the labor of at least five men a day, operating on an average of nine hours a day. Being a soft sand bottom at the plant of this company, it was impossible to operate a wheel tractor, so a crawler was called into service.



Belle City Crawler Moving Concrete Tile to Position

The crawler is a product of the Belle City Manufacturing Co., Inc., Racine, Wis. A flexible roller for the front end of the crawler enables it to roll pipe and tile in storing and shipping. The crawler also pulls four loaded flat cars for the Illinois-Wisconsin company. An electric crane spots pipe ranging in size from 24 to 72 inches and weighing from 1000 to 7500 pounds, and the crawler puts them in perfect rows through the soft sand, a distance of 300 feet, as fast as the crane can bring them. Being able to turn in its own length, it allows just twice as much room for storing purposes and the Fordson tractor on which it is installed is always on the job when needed.

CLYDE

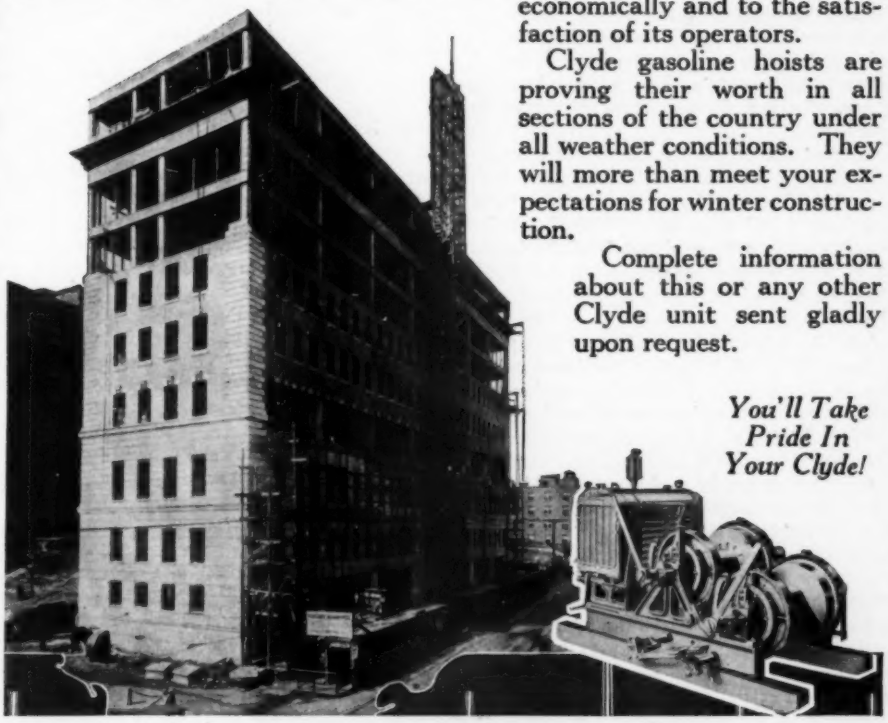
HOISTS CLYDE DERRICKS

In the illustration below is shown the addition just built to the Baptist Memorial hospital at Memphis, Tennessee by the Kaucher-Hodges Construction Company. A Clyde 35 horse power, two drum gasoline hoist was used on the main tower and handled all materials economically and to the satisfaction of its operators.

Clyde gasoline hoists are proving their worth in all sections of the country under all weather conditions. They will more than meet your expectations for winter construction.

Complete information about this or any other Clyde unit sent gladly upon request.

You'll Take Pride In Your Clyde!



CLYDE IRON WORKS SALES CO.

DISTRIBUTORS FOR CLYDE IRON WORKS DULUTH, MINNESOTA

WAREHOUSES:

NEW ORLEANS: 309 MAGAZINE ST.
NEW YORK CITY: 856 EAST 136TH STREET
PORTLAND, OREGON: 555 THURMAN ST.
SEATTLE: 3410 FIRST AVENUE SOUTH

BRANCH OFFICES:

CHICAGO: 11 SOUTH LASALLE STREET
CINCINNATI: 1913 UNION CENT. BLDG.
MEMPHIS: 69 UNION AVENUE
JACKSONVILLE, FLA.: 112 W. ADAMS ST.
SAN FRANCISCO: 739 MONADNOCK BLDG.

CLYDE TWO MARKS OF GUARANTEED QUALITY

SUCCESSFUL PERFORMANCE FOR A.G.C.

Motor Truck Haulage on Highways

By Walter C. White

President, The White Co.

WITH enormous expenditures now made annually for road construction and maintenance, the highway industry has taken its place among the country's leading industries. This great advance would not have been possible without motor trucks. Road construction costs would be doubled with the old methods of transporting materials with teams and wagons. The use of the motor truck has made road construction more rapid, more efficient and more economical.

In line with the great increase in road construction there has been a development equally as great in motor equipment and its applications in road work. The keen competition among contractors in bidding on road work has resulted in a continual striving for better and more efficient methods of equipment. The road contractor must have trucks capable of performance far beyond former requirements, rendering service with maximum dependability and at low cost.

More is expected of the motor truck today. To meet these requirements the matter of engineering design and the selection of materials become factors of increasing importance. The chassis must be designed so that there exists a balanced relationship between all the important units entering into the completed vehicle with due regard to the type of service in which it is to be used.

One of the greatest developments in the use of motor trucks for road work is in the large number of different applications of trucks and the specialized service they are rendering. Dump trucks always have been called upon to perform the major part of the construction work, and the demands of the industry have resulted in a constant development of the dump truck to meet changing conditions. In concrete road construction, the old method of dumping materials on the road bed to be wheeled to the mixer with wheelbarrow has given way to batch hauling. With batch hauling, maximum mixer output is dependent on the efficiency of the transportation system. The proper number of truck units must always be available to keep the mixer busy and the trucks must maintain their schedules. In such operations there is no room for weakling trucks. Contractors require a dump truck of more speed and power than was formerly necessary. The fast 2½-ton, 2-batch truck is increasing in favor.

Heavy-duty dump trucks also are called upon now to do jobs requiring more power and greater speed on the road. In order not to sacrifice climbing ability for road speed, an auxiliary transmission has been developed which provides an extra-low gear for operation in soft ground or on steep grades with heavy loads. This auxiliary gear permits a lower numerical axle ratio, making for faster operation on the level road.

The motor fleet used in road work by contractor or political subdivision no longer consists of dump trucks only, but many different kinds of units of several capacities and possibly dump trucks of more than one capacity specializing in certain construction work. Light trucks of 1-, 1¼-, 1½- and 2-ton capacity for the transportation of tools, labor and certain classes of materials, or in maintenance work as patrol trucks, are now a part of almost every highway fleet.

Two types of special work equipment but little used in highway work heretofore, but now being utilized to an increasing extent, are the winch truck and the crane turck. The winch truck consists of a power-driven winch mounted on a truck chassis and is used in handling, loading and hauling bridge masonry, road machinery, bridge timbers, and structural steel. It can be used in driving piles, hoisting heavy and bulky materials and performing many other kinds of service.

The truck with a crane mounted on it can also be equipped with clamshell, drag-line bucket, hook block, back filler board and hoist block. This truck is used for snow removal, excavating for bridge abutments and culverts, ditching and berming roads, placing culvert pipe, unloading cars, charging hopper bins, loading trucks, handling material and stripping gravel. There are a large number of other special applications of motor trucks, such as pressure distributors, insulated dump trucks for the transportation of hot asphalt, batch trucks, paint spraying and pavement marking trucks and many others.

A White Heavy-Duty Truck Being Loaded by a Universal Crane Mounted on Another White Truck with Motor Truck Crawler. The Trucks Are Shown Working on Excavation for the Footings of One of the Ramps Leading to the New Cleveland Union Terminal Building, the 52-Story Main Portion of Which Will Rise to a Height of 703 Feet Above the Street Level at the Cleveland Public Square. The Picture Illustrates the Advantages of the Crawler Attachment in Enabling the Unit to Move Over Heaps of Loose Earth and Rock Where a Regular Four-Wheel Truck Might Not Be Practical

With most highway fleets now consisting of trucks of many types and capacities, the handling, servicing and operating of these fleets is a matter of considerable importance. In order to secure maximum efficiency and best results, the tendency among the fleet owners has been towards standardization in order to secure the advantages and economies from the interchangeability of parts and units; the economy in the matter of time and cost in unit deplacements thus permitting maximum truck usage and low repair costs; the increased efficiency in repairs resulting from uniform methods and the familiarity from handling trucks of all one make; the need of a minimum amount of standardized shop and tool equipment; the efficiency obtained from uniform instructions in regard to driving and repairs; and the necessity of carrying fewer repair parts.

All these advantages can be obtained only when standardization is on trucks produced by manufacturers who are on a stable basis financially, whose products are backed by long manufacturing experience and who manufacture a complete line of all capacities.

Western Road and Equipment Exposition

GENERAL contractors, highway builders, engineers and equipment dealers are focusing their interest in Los Angeles where the Western Road and Equipment Exposition will be held March 7-11, 1928. This All-western, non-profit enterprise is under the auspices of the Western Construction Equipment Distributors. Heavy-duty machine manufacturers of the east will exhibit and a considerable attendance is expected from foreign countries bordering the Pacific Ocean.

The display and demonstrations will be held in the Central Manufacturing District of Los Angeles, which has donated a tract of 40 acres for this purpose. With the favorable climatic conditions existing in Los Angeles in March, the exposition will enable visitors not only to view the latest products of the heavy-duty machinery plants, but to see these machines in competitive action under the usual working conditions.